Engineering
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FACTORY

MANAGEMENT AND MAINTENANCE

MARCH 1942

IN TWO PARTS – PART ONE

HOW RCA IS BUILDING WORKER MORALE – Part Two of this issue

LIGHTING TAKES ON NEW SIGNIFICANCE – See Special Section, page 101

FOR PLANTS THAT CAN'T AFFORD EMERGENCIES

BYERS
WROUGHT IRON

With more plants working on war production today, the question is not "How much will repairs cost us in money?" but "How much will they cost us in time?" In either case, the only economical material is the one that lasts longest.

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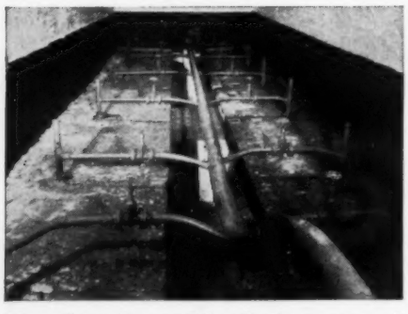
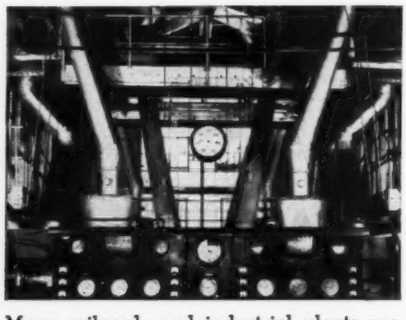


These branches and header from some of the 22 artesian wells used by a large manufacturer are wrought iron. Selection was based on the many years of service already given by the wrought iron drop pipes. Ask for piping bulletin.



Many railroads and industrial plants use wrought iron for coal handling equipment because of its demonstrated longer life. The illustration shows 7 chutes in the boiler room of a large concern. Ask for coal handling bulletin.

The ease and speed of installation of Radiant Heating recommend it for many plant heating jobs. Byers Wrought Iron provides the necessary corrosion-resistance to assure long, trouble-free service. Ask for radiant heating bulletin.

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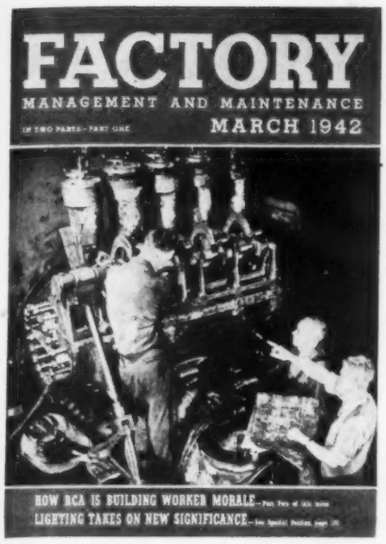
STEEL TUBULAR PRODUCTS



On the cover, in full color, a 12,500-kw. turbine is being assembled for test at one of the General Electric Company's plants. It's for a manufacturer engaged in war production, of course, and is part of a huge backlog of land and marine turbines which GE will complete by mid-1944. Size of backlog is better grasped when one realizes that it is more than a third of the active steam generating capacity built up by the central station industry since the turn of the century.

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FACTORY

MANAGEMENT AND MAINTENANCE

MARCH · 1942

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PART TWO OF THIS ISSUE

How RCA Builds Worker Morale.....*bound separately*

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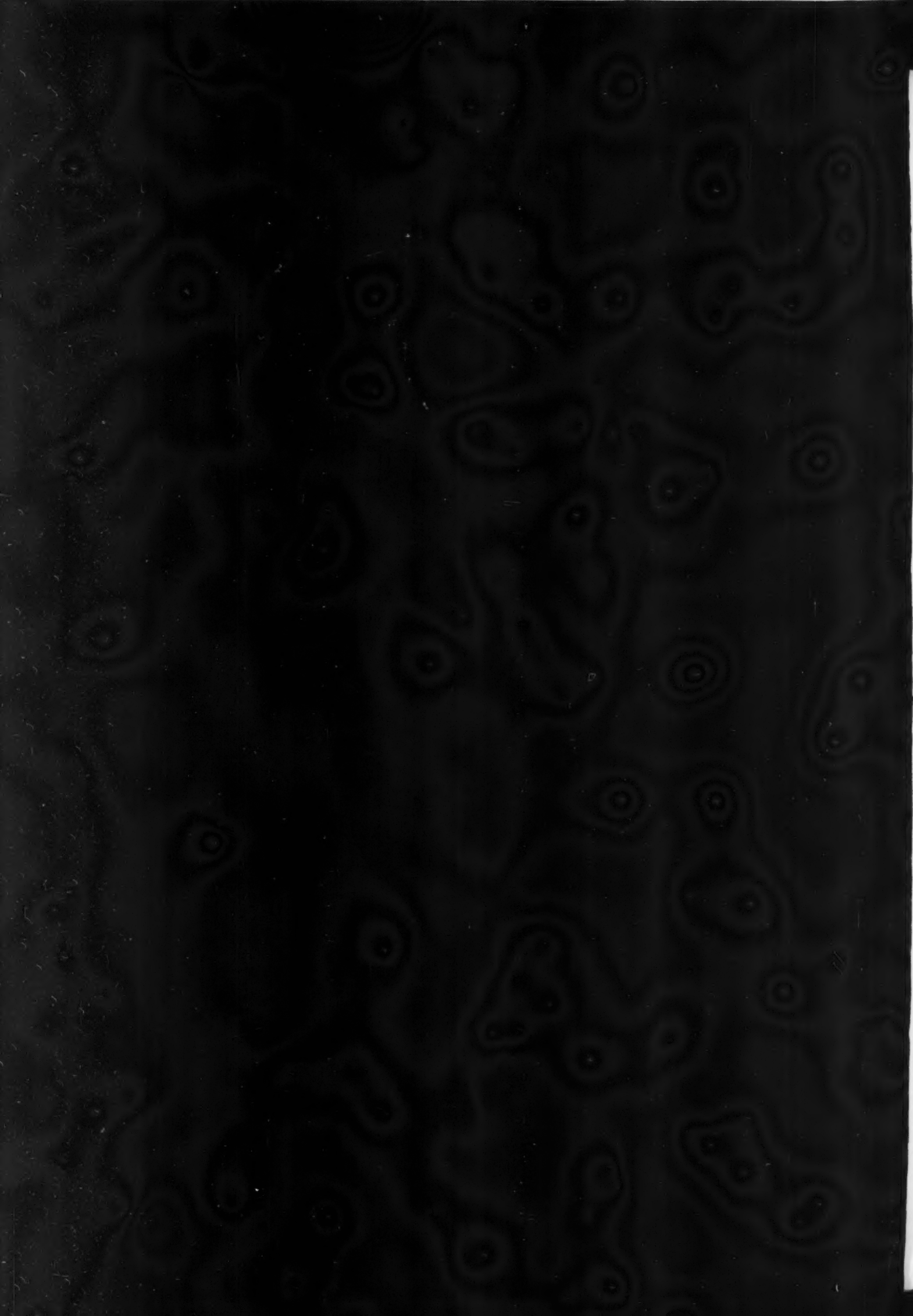


"Ten Silver Months . . ."

"EVERY WEAPON *we make today is worth ten that we might produce next year; for this year – 1942 – is the critical year in the existence of the United States.*"

This grim challenge was thrown at American industry by Donald Nelson in his first speech as chief of the War Production Board. He was speaking to a group of business paper editors, called together to receive at first hand Mr. Nelson's urgent message to the industries they serve.

"We've wasted the golden months", he declared, "the months in which we could have expanded our steel industry, our chemical industry, our copper industry, and all the others, so that we would have plenty of everything. But we still have ten silver months – the months that remain in 1942–and in them we can do things that we never thought possible."

To that objective Mr. Nelson has dedicated his high talents and boundless energy. And to that task he asks American industry to apply the full measure of its resources and skill.

That challenge should be all that it takes to exact from industry the last ounce of its energies. For by now we all can see that in this war the American way of life is at stake. American industry is the essence of the American way of life. Neither can survive without the other. So, even if it had no better reason, industry must go all out to win this war as a measure of self-preservation. Here self-interest and patriotic duty are synonymous. American industry cannot afford to let America lose this war.

The 1942 job is crucial. If it is well done we have a chance to win. If it is badly done we cannot possibly win. There is the measure of the responsibility that now rests upon the shoulders of industrial management.

It is not just Donald Nelson who asks this of industry. He speaks for the millions of fighting men – on land, at sea, in the air – the world over, whose eyes turn so desperately to the workshops of America. There and there alone can they see the hope of victory.

The people of America are not going to let those men down. They demand of industry every effort and every sacrifice that may be necessary to back them up. On that score, American industry stands, of necessity, on trial before our people. It must come through – or else!

* * *

As industry goes all out to meet this demand, its management asks of those who set its tasks and supervise its performance the utmost possible cooperation. It asks of them specifically an understanding of its problems and a chance to work them out without unnecessary interference. It asks for protection against attack from the rear while it concentrates its energies against the common foe. It asks a truce on economic reforms and social experiments that have nothing to do with winning the war and that are bound to arouse misgiving and mistrust amongst the proprietors of industry. Above all, it asks that it be not made a political scapegoat for every deficiency that is sure to develop in the confusion of a war effort.

This does not mean that industry resents honest criticism or constructive direction. Neither does it mean that it is unwilling to do its best unless it can have its own way in all things. The managers of industry are practical men. They know better than anyone else that unprecedented conditions call for new methods, that they must be open-minded to every criticism sincerely directed toward winning the victory. They know that no one can afford to be smug in the face of a national crisis.

There would be no point to my rehearsing here the pros and cons of such criticisms. Time is too short for that. Only in its performance can industry write a convincing answer to its critics. But as a help toward the achievement of that performance, I should like to clear up, if I can, one prolific source of misunderstanding and mistrust.

I refer to the solicitude of industrial managers as to where their companies may find themselves after the war. *This concern for the future sometimes is misinterpreted to mean that management is blind to the urgency of the present. But it does not mean that. It is a perfectly natural anxiety that must be felt by any responsible management operating under the American enterprise system – which is one of the things we are fighting to preserve.*

Under our system, the managers of industry cannot but feel a sense of responsibility to its owners, not merely for current dividends on their investments but also for the conservation of their properties. That means they must feel some concern over what may happen after the war to a business that now must go all out to help win the war. And their concern is but part of a general concern over what may be the effect of the war on the whole American way of life, preservation of which is our reason for being at war.

To give practical effect to that concern under present conditions is one of the problems of management. It is not an insuperable problem. Competent management will be able to surmount it, I am sure. But the right kind of help from those in authority can make the job a lot easier. And let us note in passing that the problem cannot be written off, as some critics of business seem to think, merely by setting off against it the profits that business can make on war contracts. That misses the whole point.

For a business enterprise is not, as many seem to think, just a "profit-machine." It is not set up and operated by its owners and managers for the sake of this month's or this year's profits, without regard to any other consideration.

The fact is that any worth-while business must operate as a going concern. It consists not only of stockholders and managers, but also of employees, markets, distributors, and dealers. Mostly, I might say, of markets, distributors, and dealers. They are the "reason for being" of any business, the source of its payrolls and its profits.

No competent management wants to scrap such essential elements of its business just for the sake of war-bred profits, however large they might look . . . at the moment. Most of the original reluctance to get into arms production, for which industry has been criticized, was not due to a "greed for profits", as has been charged. Rather did it arise from management's mistrust of "war profits" that can be made only by sacrificing the essential elements of a healthy business.

* * *

But now industry faces a dire national emergency. The survival of our country and all its institutions – including American business–is at stake. So management must shape its course to meet without stint every need of the war

effort. That means it must subordinate to that effort every other concern. To lose the war is to lose all. We must first win the war if we would save anything.

To the men of management that presents a grave responsibility. It is fair to ask whether government can do anything to help them meet it. One simple thing I think government can and should do. It cannot dissolve all the concerns of management, but it can help substantially.

Government should do all it can to help management conserve those assets of business that will contribute to post-war reconstruction, when that can be done without prejudice to getting on with the war.

Let me explain. Broadly speaking, every business comprises three elements. One is its tangible assets — its factories, machinery, equipment, and materials. Another is its productive capacity — its management, organization, trained working force. A third is its intangible assets — the goodwill, familiarity, acceptance, and recognition that it enjoys amongst its dealers, customers, and prospective customers.

When the nation goes to war government becomes the one dominant customer of a business. Of these three elements, the first two — plant facilities and organization — become of paramount importance to the job in hand. But so far as the government buyer is concerned, the third drops to minor importance.

But that third element cannot be ignored by the managers responsible for that business. For it will be their mainstay when they must rebuild that business after the war, when government has lost all interest in its existence, except as a source of tax revenue. That is why government can help greatly if now, during the war, it recognizes the legitimate concern of management to conserve those assets that will be essential to survival after the war.

Everyone recognizes the obligation of government to demand that the individual business go all out for war production, to forbid the production of goods not essential to wage war and to commandeer those that are, to require that a business sacrifice its markets and disrupt its distribution organization. No one questions the right of government to restrict arbitrarily the amount of earnings that a business may retain as profit from its war activities. In short, no one questions the right of government to become the dominant partner in any business that may be needed to win the war and, as dominant partner, to put the national need above any conflicting interest of the business.

But, as it does all this, government should remember that the survival of that business is staked on the public's knowledge and use of those discontinued or commandeered products, on the stability of that crippled dealer organization, on the ability of the business to maintain its standing in a market-place from which, temporarily, it may be barred.

And government can help management to deal with the exacting task it now faces, if it will do all it can to avert the needless sacrifice of business interests that do not conflict with war needs, if it will but remember that one of these days, that business again will be on its own, gathering up whatever resources it may have left, recreating its markets, rebuilding its distribution channels, reestablishing itself as a going concern . . . and doing all this in a competitive world without benefit of war orders.

The only foundation upon which any business can hope to rebuild when that day comes is its customers' memory of its name and their understanding of its products. Whatever credit may be coming to it for its war effort will not avail it very much if it permits itself to be forgotten. Its chief assets in that day will be the identity, recognition, and acceptance it still enjoys amongst those to whom it must look for business.

That is why so many business men, already going all out on their war jobs, become apprehensive whenever some word or act of a legislator or government official seems to question the validity of their sales, promotion, and advertising activities during the war. For they know that it is by such measures alone that any management can hope to conserve — while its business goes to war — the values it will need when it returns to civilian service.

That is why I ask government to do all it can to allay such uncertainties, to reassure business of its desire to help conserve those intangible assets that mean so much to business security. For that, I believe, will strengthen the hand of management in a big way as it goes all out on the vital job Donald Nelson has staked out for industry.

* * *

He has told us that if we are to make these ten silver months productive enough to make up for the golden months that are gone, industry must do things it never thought it could do. That is dead right. For America now finds itself in a position it never thought it could be in.

All too slowly, but very surely, it is dawning upon us that this is OUR WAR. Moreover it was our war long before we knew it or did much about it. So our job today is not merely to match the current production of our enemies. That is not enough. We must produce also enough to match the surplus of resources they had built up before we got started. We must produce enough not only for our own needs, but also for all the United Nations.

Moreover we must produce all that we need for *decisive* victory, for anything short of that will mean defeat. If we would save the American way of life, we must destroy once and for all the forces that threaten it. A stalemate would mean but an armed truce and what that might do to the American way of life and to American industry no one dares to guess. Victory must mean *decisive* victory. And this, very definitely is our war.

And just as definitely, this is OUR YEAR. For in this year — 1942 — we must prevent our enemies from achieving an advantage that might put victory forever beyond our reach — despite all our vast resources. It is an appalling fact that victory may slip beyond our grasp — not in 1943 or in 1944 — but during the months just ahead of us.

"Industry's responsibility in all of this is great," says Donald Nelson. "The job will take brains and initiative, but we can do it if we go out with a will."

To Mr. Nelson, that initiative means that industry must lead rather than follow in the march to more intensive use of our machines and our man-power. We dare not wait for new facilities to meet our mounting needs. More and more we must press for more widespread subcontracting and conversion. And he is counting on that initiative, backed by ever more aggressive effort, to avert or to minimize the compulsory measures that now seem imminent.

"We must stop thinking about what we're going to do to the enemy in 1943 and start thinking of what we're going to do to him in March of 1942.We must make today the things we would be making next year . . . if we had the time to spare."

That, says Donald Nelson, is the task of American industry during the next "Ten Silver Months." And to that gigantic task American industry now must bend every ounce of its abundant strength.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This message is appearing in all McGraw-Hill industrial and business publications, reaching over a million readers.

FACTORY
MANAGEMENT AND MAINTENANCE
L · C · MORROW · EDITOR

This War Is Up to Industry

This war is up to industry. The further we get into it, the firmer becomes that conviction. It is industry alone which can furnish the armament and other equipment necessary to win.

What armament, what equipment, and how much, must be decided by Washington. After that, *how soon* is in the hands of industry.

The production job is gigantic. Industry has to make up in two years for ten years' production by our enemies.

There is no single set of procedures by which results can be guaranteed. But there are many individual things to be done which, if carried out extensively, are most likely to add up to the correct end result. Among them:

1. Get more production per machine.
2. Get more production per person.
3. Put more machines to work.
4. Put more people to work.
5. Conserve and reclaim materials.

The ramifications of these five are many. Every tool in management's bag will have to be used. And then some.

With no attempt to present them in any particular sequence, suppose we indicate some of these tools by listing things that can be done:

a. Improve the machining, fabricating, and assembly layouts.

b. Re-examine feeds and speeds.

c. Revise handling methods.

d. Motion-study layouts, jobs, and workers.

e. Improve and maintain worker morale.*

f. Devote a greater percentage of equipment to war work and take on more subcontractors (if a prime contractor).

g. Go after war work hammer and tongs (if not a prime contractor).

h. Go in with other shops to form a contracting pool (if neither prime or subcontractor).

i. Increase shifts.

j. Train women and older men.

k. Suggest to the government substitutions and changes in design to conserve materials.

l. Do an effective reclamation job.

Actually, the thorough doing of the things enumerated, plus others that naturally supplement them, constitutes the application of good management principles. That kind of management was born of American initiative. It follows the lines adhered to in building almost every American business.

That is very much as it should be in America. Since we must have a war, and since that war must be a war of production, it necessarily follows that this war must be up to industry.

L C Morrow

* See part II of this issue, a self-contained report on "How RCA Builds Worker Morale."

How Subcontracting Can Be Made to Work

Prime contractors *must* find new sources! "Little" industry *must* fight for contracts! Widespread *Factory* study reveals that we've muddled too long with our most critical production problem. Government can't solve it. Industry's got to do the job

LET'S TAKE A GOOD, CLEAR LOOK at this vital question of subcontracting. Where do we stand? Much has been written, said, and done about it. Yet the complicated problem of spreading war work throughout industry remains largely unsolved. And the final solution will depend not on the government but on industry itself.

For industry's information, FACTORY has conducted an intensive two-week study of the question. FACTORY editors have interviewed management men in "big" and "little" industry, officials of the Army, Navy, and WPB, management engineers, and industrial association executives in New York, Washington, New England, Middle Atlantic States, and Middle West.

The following report condenses the off-the-record, candid views of these men, each of whom has actively worked and thought over the problem with hundreds if not thousands of others. In every interview FACTORY has pursued a generally similar line of inquiry, seeking fundamentals on which men of such differing points of view and experience could agree. In addition to the over-all picture drawn from these interviews, FACTORY reports and comments on some of the practical programs and plans that are being employed to widen industry's application to war production.

Here, first, are a few of the primary questions and a consensus of replies.

1. Is subcontracting a success? No. There has been progress, but "the village blacksmith" is still waiting for war work. He will wait a long time. While exact statistical measurement is impossible, a confidential "sampling" survey has indicated that about 25 percent of defense production is currently under subcontract—an improvement over the estimated 15 percent of last September but a far cry from the 50-plus percent that our Axis rivals are said to have achieved.

2. Can subcontracting succeed? "It's got to. It's a matter of national life and death!" exclaims a key official. "We simply can't win if we depend entirely upon new facilities." This is borne out by WPB's tentative estimates that no less than $8,000,000,000 and perhaps as much as $15,000,000,000 of 1942's scheduled war output of $56,000,000,000 must be produced with facilities not previously used for war purposes—over and above current subcontracting and the speed-up of current operations—if the Victory program is to be achieved. This *can* be done. And certain decisive factors are working in favor of the prospect that it *will* be done.

3. Why has subcontracting lagged and whose fault is it? If there were a single, easy answer to this many-headed question, the whole problem would have been solved by now. In general, both the government and industry have muddled, have lacked a clean-cut policy, have missed the boat on fundamentals.

4. What needs to be done? There are almost as many answers as there

CALL IT SUBCONTRACTING OR "

From freight cars to cargo ships —and producing one every week

From vending machines to dies for bullets—same men, new job

From silverware to reflectors —an expert turns to war work

From rock crusher shafts to gun mount parts on a Naval contract

Subcontracting? Just another name for production itself. Here producers examine some "bits and pieces"

are men to propose them, as many expedients as there are localities and industries to experiment with them. Some of these have seemed so pat and so simple as to divert our thinking from the fundamentals. Essentially, most observers agree, industry must find the way.

5. *What are the fundamentals?*

a. Subcontracting is a basic, natural procedure in practically every successful industrial operation, in war or peace. It is, in fact, just another name for production itself.

b. That being so, our sole central objective should be to *stimulate* the natural work-spreading process by every sensible method available (not forgetting that industries and companies differ tremendously and are *not* uniformly susceptible to any single expedient).

c. Any other approach, such as the salvation of "small business" or the re-employment of priorities-displaced labor, is in conflict with the central objective because these things put the social cart before the production horse.

d. Finally, there are bound to be limits to the effectiveness of Washington wand-waving. Look at it this way: Industry's policies have always been dictated by its customers. To the extent that government becomes industry's biggest customer, government policy will control industrial policy;

R "CONVERSION"—IT'S VITAL!

From phonograph parts to plane controls

Photographs from OEM

From auto safety signals this firm turned to searchlight job

Other Unusual Examples:

From	To
Merry-go-rounds	Aircraft and tank work
Orange squeezers	Bullet tools, gages
Hair curlers	Aircraft assembly clamps
Cash registers	Automatic gun parts
Lawn mowers	Hubs for tanks
Carpets	Gun barrels
Toy trains	Binnacles, compasses, gun sights
Linoleum	Shell casings
Zippers	Gages
Pipe organs	Test tube stands

A more complete list is given at the end of this article

but government *action* on subcontracting can affect only a small area of industrial action. The development of the natural workspreading process is an *operating* problem that will remain primarily in the hands of operating *management*. Government can, with more success, tell industry *what* to do than it can say *how* to do it.

Now to particularize these contentions under the topical headings that most naturally suggest themselves to the reader.

What's in Prospect?

The biggest single stimulant to greater production through workspreading is rapidly taking effect, thanks more to the Axis, perhaps, than to any other factor. That stimulant is the sheer magnitude—at last fully recognized—of our war requirements as reflected in mounting piles of orders on "big industry's" books. Until recently industry had not been actually overwhelmed with orders. But the size and urgency of the Victory program is already acting forcibly to compel both the government and industry to hunt up new sources of supply.

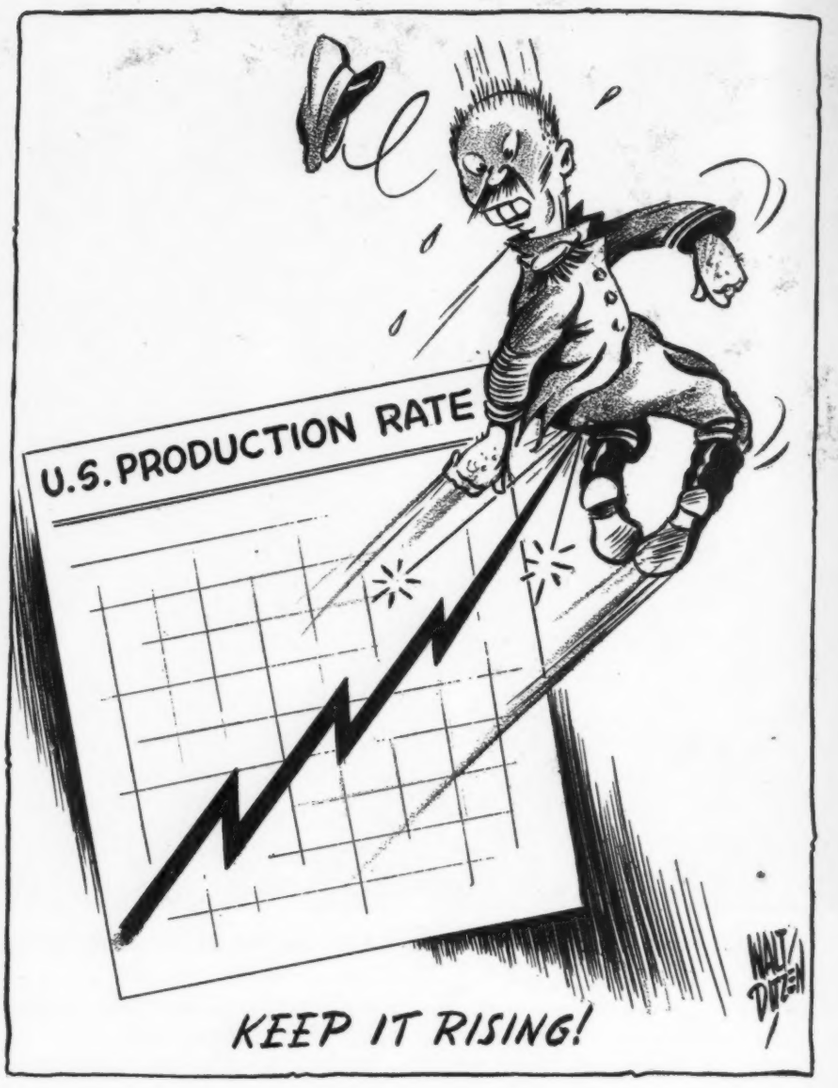
In prospect, then, is vast production and business aplenty, especially for those who can work, or learn to work, metals in this war of metals. How, precisely, this business will be pitchforked out into industry remains to be seen. Scores of promising ideas are boiling in official brains, but the indications are that the burden of the job will fall finally on industry. Many ideas will be tried and some will prove helpful. *The one major government action that seems predictable at the moment is some attempt to make a certain percentage of subcontracting mandatory on prime contractors.*

How About Small Business?

Despite Congressional outcries to the contrary, the notion of saving "small business," as an end in itself, is completely dead. Reports from the field indicate that serious "distress cases" have not been numerous to date. *Dun's Review* reveals that there were actually 12 percent fewer business failures in the first eleven months of 1941 than in the same period of 1940. There were 842 failures for November, 1941 (last month reported); 970 for June 1941; 1,024 for November 1940; and 1,184 for November 1939.

"The 'little fellows' seem mostly to have found some way of living off the shelves," is a characteristic comment. Christmas retail trade broke all records, while January 1942 appliance sales ran well ahead of January 1941. The expected heavy "priorities unemployment" totals only 400,000 by current estimates. General unemployment is reported by the National Industrial Conference Board to be running at its lowest levels since 1930.

On the other hand, the proportion of manufacturing failures among total failures has increased recently, indicating that the pinch is beginning to be felt. In most cities the characteristic victims are the proprietors of sheet metal, woodworking, textile, leather, rubber, and welding equipment. Some of these may yet find salvation in government orders for commercial supplies; many others will undoubtedly perish, but the owners of machine tools will probably survive.



Truly "Small" Industry

It is a harsh fact that truly "small" industry is not a large employer of labor and hence not the biggest factor in the production picture. Of the 184,230 plants listed in 1939, 152,884 (or 83 percent) employed a total of only 1,674,335 persons (or 21.5 percent) out of the 7,886,000 persons then engaged in manufacturing.

It has been said repeatedly that 56 of the nation's industrial companies have received 75 percent of the dollar volume of war contracts. This figure was true enough at the time of its release last Summer. No later data are

(*Continued on page* 210)

What Women Are Doing In Industry

They're learning how to make munitions, assemble planes, run machines, getting ready to pinch hit for men, do their share in America's war effort

IT'S NOT MUCH MORE than a trend at present—but it's definitely on the way—the induction of America's woman power in industry.

Women have been working in factories for many years. But mostly they've been doing the small jobs that try men's patience, light assembly, simple inspecting, labeling, packing, sewing.

Now they're going to have to do harder work, run bigger machines, take on more responsibility, take over jobs that were formerly considered purely masculine, so that younger men may be released for active duty, and older men for the still more skilled work.

What effect will this influx of women have on industry, and what must plant operating executives do to prepare for it?

FACTORY has been asking a few questions. From the answers come these deductions:

Chances are about even that unit costs will show slight variation. In companies that pay a lower wage rate to women—and they seem to be in the majority—the lowered rate is offset by lowered production. Companies that pay for the job, regardless of the sex of the worker, seem to find no change in the production rate; therefore unit costs also remain the same.

The training picture is undergoing rapid changes. Formerly, except in special instances or for particular jobs, training of women was done almost altogether on the job or at the machine. Now, all over the country, classes are being formed and courses outlined to teach girls and women how to read blueprints, operate lathes, run machines, and use tools—especially as these things apply to war supplies. Engineering schools that formerly accepted only male students are opening their doors to women. Special courses in various phases of plant engineering for college graduates, and mechanical courses for high school graduates are being sponsored by companies, public and private schools, state employment boards, and the NYA, either in cooperation with one another or individually. There should be no lack of women with at least a rudimentary knowledge of factory operations when these schools start turning out their graduates.

But there doesn't seem to be much hope for women supervisors or forewomen. Almost unanimous is the opinion that women work better when the boss of the department is a man. Group leaders seem to be accepted, but the court of last appeal would still be of the stronger sex.

In ordinary matters of discipline, women are more amenable than men, according to the majority of plant executives questioned. "There is less tendency toward radicalism among the girls," says one plant manager. "This tends to increase the value of the girls as steady, satisfied workers, resulting in better cooperation."

Pre-employment tests have not generally been used for women, but that picture looks as if it may change, because aptitude tests are usually given before pupils are accepted for training courses.

Almost all companies give their women employees pre-employment physical examinations, but only one of the firms questioned employs a woman doctor. They all have nurses in full-time attendance. In some instances these nurses also act as ad-

Vultee photograph

visers to the girls, because in only a few plants are women employed in the personnel departments to take care of grievances or disputes. Usually such difficulties are handled through regular union channels.

Less than half of the companies questioned either provide uniforms or insist on their being worn. Some plants emphasize "sensible" clothing, some will not allow high-heeled shoes, others forbid jewelry. It all depends on the type of work being done. Where absolute cleanliness is a factor as in food plants, uniforms are always provided for obvious reasons.

In many instances an increase in the number of women employed will mean an addition to restroom and washroom facilities. Most states have laws covering minimum requirements for women employees. Cafeterias and dispensaries are as a rule considered to be adequate and no change is contemplated.

Changes in laws and special dispensations are allowing women to work longer hours, overtime, and Sundays, and most firms are taking advantage of these changes. Fifty-four hours in a week is the longest working period reported.

The opinion is unanimous that women are at least as careful as men. Not one instance of increased accident rate is reported, and no special guards are provided for women that are not also used for men on the same machines. It should be pointed out, however, that as a rule women work in less hazardous locations, and on the less dangerous jobs.

All in all, it looks as if women can be absorbed into industry with a minimum of disturbance of regular routines and a maximum of benefits where their hiring becomes a necessity because of the shortage of male labor.

Women in Wartime Britain

An interview with Caroline Haslett, Adviser to the British Ministry of Labour on Women's Training

Caroline Haslett was the first secretary of the Women's Engineering Society (now she's president) and first director of the Electrical Association for Women. She organized the Simplified Course in Engineering and Electricity for the Home Office and the Board of Education, founded the International Women's Service Groups. Is chairman of the British Federation, and a member of the Central Committee of Women's Training and Employment. All this, plus being editor of *Woman's Engineer* and *Electrical Age*, readily explains why she now is adviser to the Ministry of Labour on Women's Training, and associated with the Women's Consultative Committee

IT TOOK THE SHOCK of Dunkerque to bring home to the British the necessity for using every available ounce of man-power for the production of weapons of war. And that meant woman power too. Not only could women substitute for men at machines, they could also add materially to the total labor hours that were so necessary if sufficient war material was to be obtained to keep Britain safe on its "tight little isle" and allow it to play its part in the general theater of the war.

Thus the beginning of the training of women for industry. In October, 1940, the first 8-week courses in bench work and machine shop practice were opened to women. In January, 1941, British government training centers also were opened to women, giving 3-month courses. In addition, of course, many companies inaugurated their own training courses.

Right from the beginning certain principles were laid down. Men and women should be trained side by side. Women as well as men should be trained to the limit of their capacity —which has given women an additional incentive to put more effort into war work. There should be no upper age limit; employers have found to their surprise that although older women are comparatively slow in learning skills that involve finger agility, this slowness is more than offset by their enthusiasm, determination, and sense of responsibility. In skilled jobs, the rate for the job should be paid to men and women alike.

All trainees are paid while learning. They receive an extra allowance if they have dependents. If they have to use their bicycles to get to work, they get an allowance for them, too. And, of course, they are served meals at reasonable prices without ration cards—as if they were already at work.

It wasn't possible to throw a great number of women workers into industry without some preparation. Special arrangements had to be made to take care of them. Restroom facilities, canteens, factory inspectors, welfare workers, nurses, hospitals, air-raid shelters, all had to be taken into consideration by every company that added large numbers of women to its industrial payroll. Problems of hours of work had to be solved, especially for married women who also had homes and children to care for. Not a simple puzzle that could be solved in an hour, but one that is working itself out, through the efforts of the Ministry of Labour cooperating with the various trade unions.

In accordance with the original principles, women are upgraded as fast as their capabilities develop. That they are able to take hold and do a job is proved by responsibilities they have assumed. One large machine shop working for the Admiralty has but one man on its payroll. The forewoman in charge had some engineering experience in the last war, and continued her training under the Women's Engineering Society scheme. The machines are mostly revolving turrets of special design, and women with no previous factory experience, after short training periods are acting as setters. Some airplane factories employ as high as 70 percent women workers. In every line women are doing their part, side by side with the men.

Women at Westinghouse

NEARLY EVERY WESTINGHOUSE plant employs women, especially for jobs that require dexterity with tiny parts.

At the East Pittsburgh plant, for instance, women tape coils. The thickness of each coil must be identical to within close limits, so the job requires feminine patience and deft fingers.

Another job that calls for unlimited patience is the inspection of moving parts of electric instruments made at the Newark plant. Here a magnifying glass, similar to those used by jewelers, has to be employed.

Thirty-one pieces are assembled into a thermostat control for refrigerators at the Mansfield works. Westinghouse finds that women can handle these minute parts, and are willing to perform the highly repetitive operations that this type of assembly requires.

Training for these and the many other operations performed by women is done right on the job. At first, of course, production rate is low, but the cost of training is absorbed in a special training account, so no change is made in the standard cost.

Although no women supervisors are employed, girls act as group leaders. These leaders are responsible for the efficiency and conduct of the members of their groups, and from them are chosen the full-time instructors.

Girls put together the 31 parts of thermostat controls

Taping coils calls for women's tireless patience

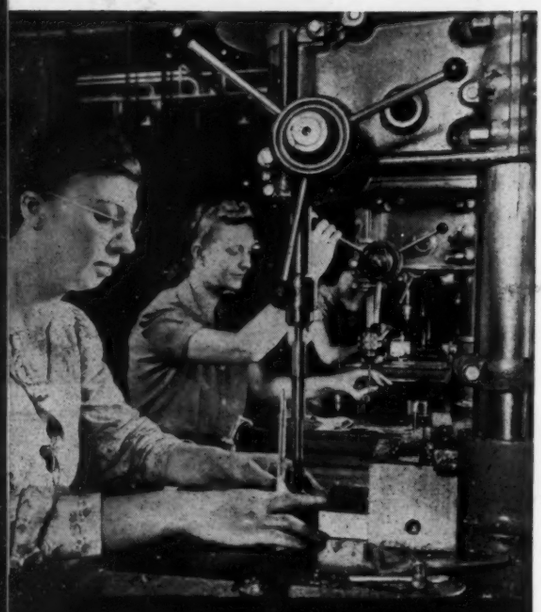
Inspecting moving parts of electricel instruments

Women at Vultee

SINCE VULTEE AIRCRAFT, Vultee Field, Calif., broke traditions of the industry and began hiring girls for actual shop work, women have worked shoulder to shoulder with men and proved their ability to handle a variety of jobs in practically all departments.

Each is paid on the same wage scale as the men with whom they work in such departments as machine shop, subassembly, sheet metal, paint shop, power plant, inspection, and even on the final assembly line. In fact, women are now in every manufacturing department, except the foundry and hammer shop, pattern shop, and center wing assembly department.

The policy of hiring women for shop work at Vultee was well beyond the experimental stage long before Sidney Hillman issued his pleas last summer for defense manufacturers to begin this practice. By that time Vultee's program had already proved that women workers could be used advan-



More than 30 different operations on the production floor are performed by women at Vultee

tageously to increase the production of military aircraft.

The first 50 girls were given minor jobs last April, freeing an equal number of men employees for more important tasks within the factory. Because of their known manual dexterity, the girls were put to work in electrical and radio subassembly attaching wires and junction boxes where space is at a premium, and in the trim department sewing fabric on ailerons, rudders, and elevators.

The ability these girls exhibited to withstand successfully the routine of repetitive operations soon led to their being tried on various jobs through the plant, such as putting together small subassemblies, operating light rivet guns, drill presses, paint sprays, and installing fittings and equipment in fuselages on the assembly line.

Women are now used on some 30 different types of direct production jobs, some of which reach into the upper wage brackets, such as aluminum welding, precision and Rockwell inspection, and hand turret lathe operation.

These women have less tendency than men to change their employment from one plant to another. The turnover figure for women employees is exceptionally low. Moreover, the number of women who take advantage of free trade extension training classes available to company employees is slightly greater in proportion to employment than the men enrolled.

Average wage of Vultee women is about 71 cents an hour. This average will increase steadily as the majority who have been recently employed and become eligible for more than beginners' wages.

No unusual problems have been encountered in the employment of women. The only regulation which they must observe is that they wear slacks and closed-toe, low-heeled shoes to work. They are limited to 8 hours' work per day by California law. Otherwise regulations for them are the same as for men.

Safety Clothing for Women

Nothing loose or flowing that can get caught in moving machinery, low-heeled shoes, covered hair—are among the safety recommendations for women's clothing

IN INDUSTRY the well-dressed woman is the one who is dressed for safety—but that doesn't mean she must be unattractive.

What type of clothing to provide, depends greatly on the kind of work to be performed. Near moving machinery, no wide skirts, no loose sleeves, no flowing ties, no frills of any kind. Slacks with tucked-in blouses or coveralls are safe and attractive. Neither slacks nor sleeves should have cuffs, and all kinds of loose pockets should be avoided. Long sleeves with tight cuffs are practical, but long sleeves rolled up constitute a real hazard. Whatever the type chosen, the clothing should be well cut and comfortable, with plenty of room for free, unhampered movement.

On bench assembly or any other work that presents no special hazards, a simple short-sleeved dress or uniform is suitable.

Shoes are important. Not only do uncomfortable shoes cause undue fatigue, they can also be a hazard. It is interesting to note that one of the commonest forms of accidents in plants that employ many women is "tripping on the stairs due to catching heels." For comfort and safety, low-heeled, closed-toe shoes should be insisted upon. The low heels are more comfortable, prevent turned ankles, help against slippage. Closed toes prevent injuries from stubbed toes and the entrance of small particles of metal or other materials.

Long hair is a serious problem. The same static electricity that makes a girl's hair follow a brush or comb, can cause terrible accidents in a plant.

Women who wear their hair long, seldom want to cut it—so proper head covering must be considered. Hats, caps, turbans, nets, are all possibilities. To get the best answer for any individual plant it is often advisable to put the problem up to the girls themselves, and let them devise a head covering they all like.

In certain occupations it is necessary to wear gloves—but they should never be allowed near moving machinery. Here other protective means must be taken—such as one of the various pastes which protect the skin but do not impede finger action. It is important that such protective covering be easily removed by a suitable soap cleanser.

For handling sharp or rough objects, leather and heavy cotton gloves are available. For protection from various chemicals or acids, gloves made from one of a number of synthetic materials are most suitable. Rubber gloves, even if obtainable, are uncomfortable, and subject to deterioration.

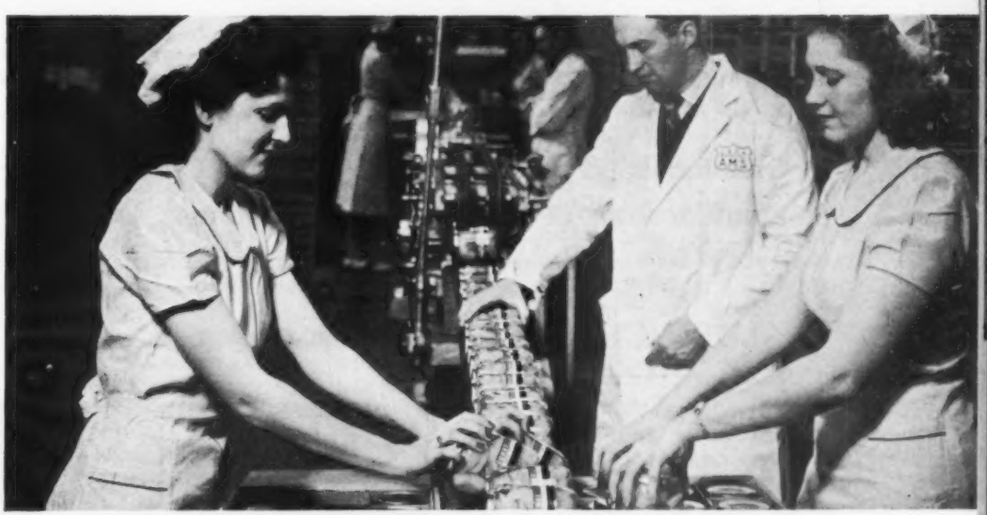
Where there is any danger to eyes, whether from flying particles or bright light, goggles of the proper type should be provided, and no girl be allowed to work without them.

Visible jewelry should be strictly taboo anywhere near machinery. One manufacturing company with an unusually good safety record forbids even wedding rings to be worn at work. Bracelets, earrings, necklaces, wristwatches are all hazards.

There is safety clothing for practically every type of work—and it pays to insist that it be worn. Not only does it reduce many hazards, but the knowledge that her clothing is as safe as possible also makes it easier for a girl to put her whole mind on her job. And most women like to wear uniforms of some kind. Uniforms add to their feeling of importance, and thereby improve morale.

Johnson & Johnson, New Brunswick, hasn't made up its mind which of these two uniforms to choose

Simple white uniforms with short sleeves are best for packing foods



First prize in a contest for women's defense clothing sponsored by Traphagen School of Fashion, New York, features free-action sleeves, tight trouser and wrist cuffs, utility pockets. Made of sturdy cotton for easy laundering

Style and safety are combined in uniforms designed by Lillian Palmedo, New York

PLANT CONVERSION

On their way—full lifeboat equipment for one cargo vessel, all ready for installation

From Stoves to Lifeboats

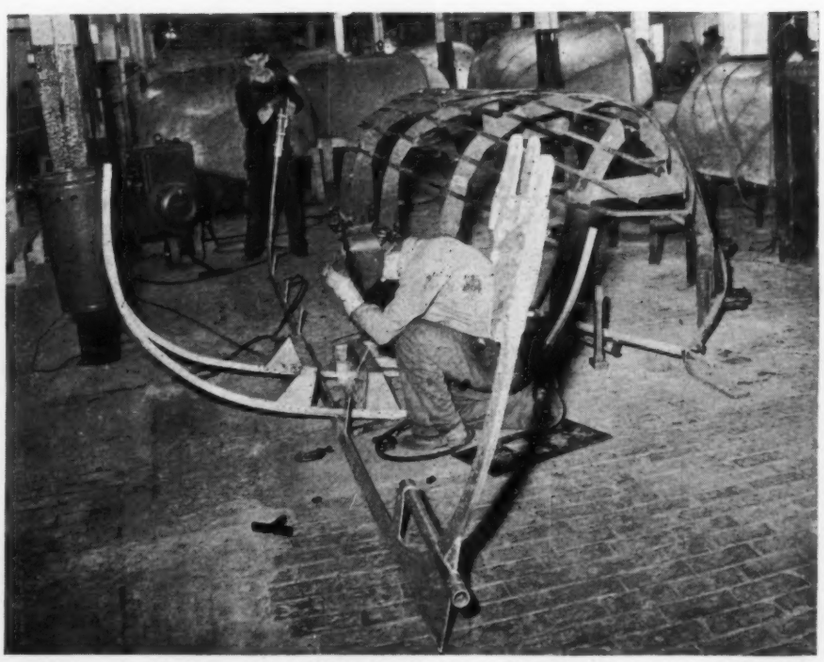
One thousand miles from the Atlantic Ocean, 2,000 miles from the Pacific, but manufacturer of gas and electric ranges is turning out a complete lifeboat every two hours—enough to equip one cargo vessel in each 8-hour shift

ALDEN CHESTER, Vice-President, Globe American Corporation, Kokomo, Ind.

PICTURE A COMPANY that has been building cooking and heating stoves for more than 50 years, with a prime contract for 1,248 seagoing lifeboats on its hands, and suddenly turning them out at the rate of one complete boat every two hours.

That's us. In response to the government need for war production, we went into the boat business overnight. We had to convert a major portion of our plant facilities to the manufacture of standardized steel lifeboats. And to make them we are using the same methods of production that we have used for many years to build stoves and ranges. But we started over a year ago to make our plans, to be ready for what might come.

To meet the present emergency the Maritime Commission has standardized the design of cargo vessels and their equipment. All that was available for lifeboats, however, were minimum specifications regarding size, material, air-tank capacity, and so on, as established by the Bureau of Marine Inspection and Navigation. So it was



In the motorboat—one of each four built—engine bed is welded to keel before being mounted in steel form

Fitting galvanized steel sheets on lifeboat form. Boats in background are on an endless track, timed to move a specified number of feet per minute and the necessary men are employed to do the job

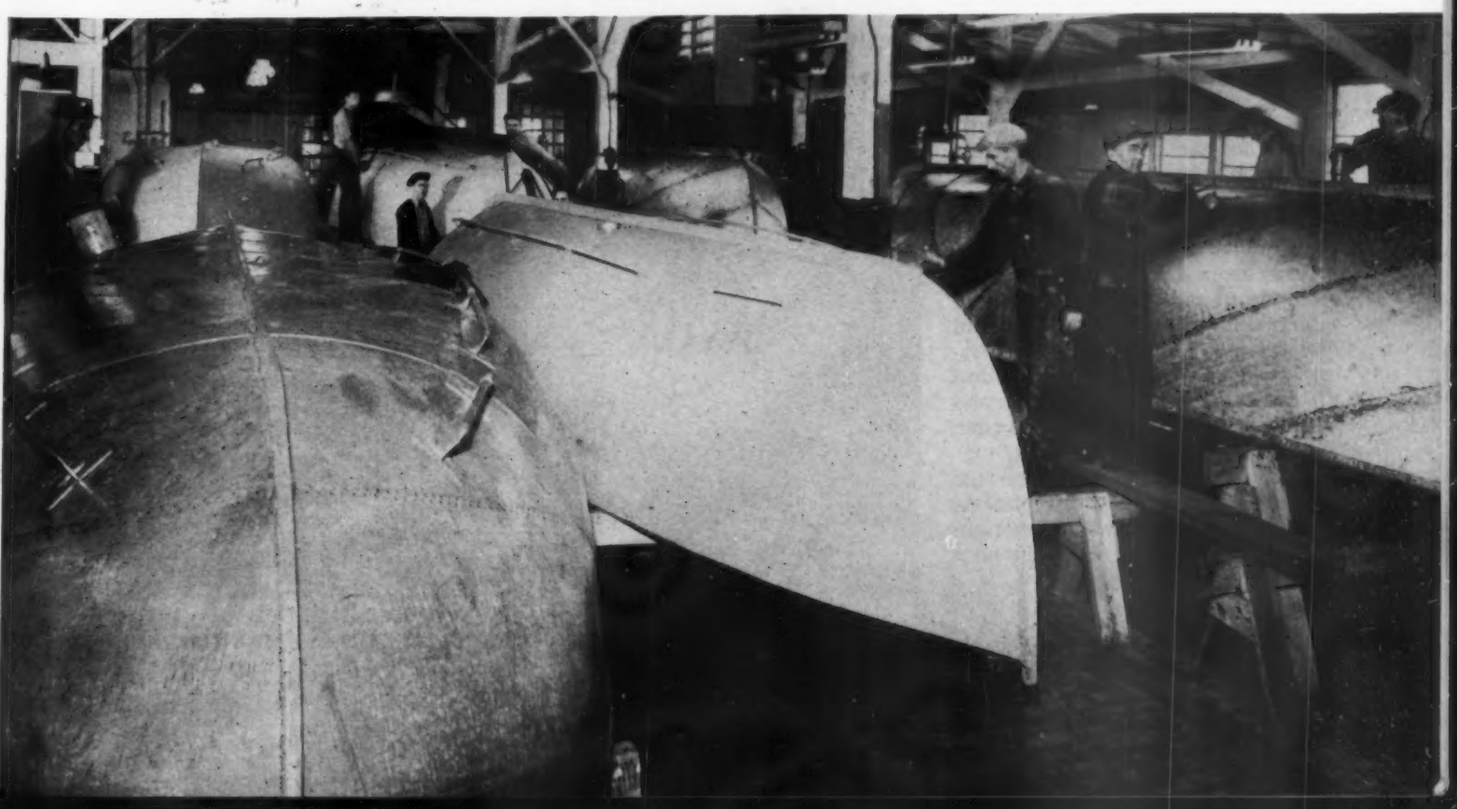
necessary for us to create our own design. This required several months of study anad effort, as well as a sizable investment.

We employed naval architects who designed a new steel lifeboat that was good enough for the Maritime Commission to adopt as standard equipment for the 312 cargo vessels it already had on contract. Our first order for these lifeboats called for 1,248 identical boats, of which 744 are being built in our plant at Kokomo, 200 in New Orleans and 304 in New York.

Small boats, such as lifeboats, mostly of wood construction, have usually been made in yards along the coast, a few at a time. Facilities were not available for large production. That is why our company had an opportunity to get the principal contract for building this equipment, even though we are a thousand miles from the nearest coast line.

Construction is entirely of steel, except for wooden floorboards, seats, mast, oars, and rudder. The boats are equipped with chocks, releasing gear, oars, red sails, food and water, signaling and first aid equipment, canvas covers, hood, and weather cloths. Boats are moved by power conveyors along the production line from the

Finish riveting platform. The grabrails shown on the boat in the left foreground are for sailors or passengers to hang on to in case the lifeboat should happen to be overturned in the water



Lifeboats on endless track in various stages of production. Although they are standard for all boats, each mast is fitted individually. Notice the rods in the second boat, ready for the heavy waterproof canvas hood that is part of the regular equipment for each boat

time keels are laid until they are loaded into railroad cars. The speed of the line is set according to requirements, and the necessary number of men are employed to do the job. We now equip one cargo vessel with every 8-hour shift—but this production can easily be doubled or tripled by employing two or three shifts respectively. This is more than sufficient capacity to provide all the lifeboats required for the entire emergency shipbuilding program. We estimate the total capacity of our plant, if devoted exclusively to lifeboats, would supply the necessary life-saving equipment for the launching of nine cargo vessels a day.

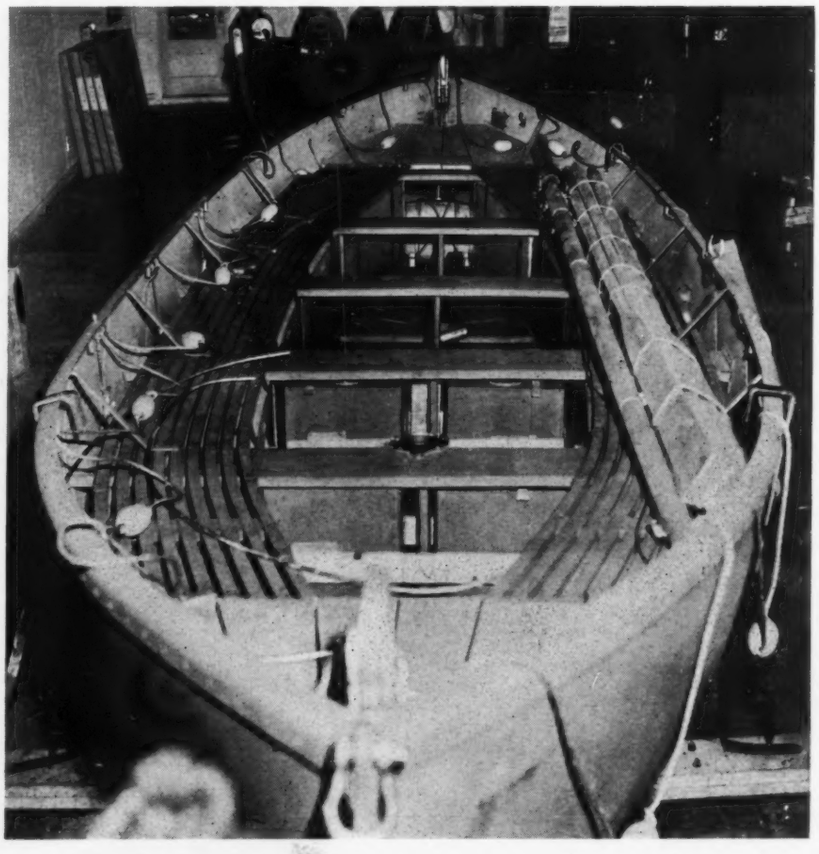
The Liberty Ships carry four lifeboats—one of which has a built-in motor—each with a capacity for 31 persons. This provides room for approximately twice the number of seamen usually carried. That is because there must be sufficient lifeboat capacity for the entire crew on each side of the ship.

Something New

Four boats are shipped from our plant in one railroad car every day to various shipyards on the Atlantic and Pacific Coasts, and the Gulf of Mexico. The shipbuilders simply unload the lifeboats from the railroad car and install them on the deck of the vessel. They require no additional work.

Although this method is new in the boat industry, we believe it represents a good example of what American manufacturers can do under the pressure of a national emergency.

All ready to be loaded. Three of the storage compartments will be filled with food, the fourth with first aid equipment, signal lights, and so on. Water cask can be seen under rear deck



Significant Labor Developments

Period surveyed: January 10 to February 10

TREND INDICATORS

A NEW APPROACH to regulation of picketing was undertaken by a city in California (Pomona) which imposes a per diem licensing fee on unions for "outside" pickets hired by them. The fee is not payable for pickets who are employees of the firms picketed or who have been employees within the previous three months.

Bans Spite Picketing

The New York Appellate Court, in holding that an injunction may be issued to prevent spite picketing, ruled that such picketing does not involve a labor dispute and is purely retaliatory and malicious. (London Character Shoe Corp. v. Davis.)

Responsibility of Labor Union

The Secretary of Labor in her annual report (Jan. 26) called attention to the fact that "trade-unions will now be kept constantly under what we may term social surveillance as other American institutions are—banks, insurance companies, stock exchanges, etc."

New York Waives Labor Provisions

The N. Y. State Department of Labor will entertain applications for leave to work women 7 days a week or on a 3-shift basis, or to waive other provisions of the law. Provisional license will be granted when failure to grant such leave would interfere with war production, when a high priority rating is involved, or when the Army Department, the Navy Department, or WPB requests such permission.

Rehiring Selectees

In first rulings on rehiring employees discharged from military service, the Comptroller General decided that, to be entitled to reemployment, the selectees must be capable of performing his duties within 40 days of discharge from the armed forces and that informal application is sufficient to satisfy the requirements of the law. The Attorney General has announced that where a position to which the selectee is entitled has been abolished, every effort must be made to restore him to a position of like pay and seniority, but permanent employees, as distinguished from replacement employees, should not be discharged to make room for him except upon consideration of all the facts.

Employees Accused by Army and Navy of Subversive Activities

The War, Navy, and Labor Departments have agreed that unions may appeal any discharge required by the Army or Navy because of subversive activity. If it is found that the charges of subversive activity are not justified, the employee must be reinstated and paid back wages at the expense of the government agency.

Full Labor Relations Data Required By SEC Registrations

A recent order of the S.E.C. holds that failure to describe "unsatisfactory" labor relations in a registration statement is to be considered "materially misleading to investors".

NATIONAL LABOR RELATIONS BOARD

Management Need Not Recognize Coercive Contract

Management need not recognize a coercive and unfair contract with a union. This holding is of particular significance because it was the Labor Board, not a Court, which so ruled. The case was one in which a union squeezed out of their jobs eleven employees who had been induced to join the union. These employees applied for membership, and while their applications were utilized to insure a closed shop, immediately after the contract was entered into they were denied membership, and others from the union were sent to replace them. Although the employer was ordered to reinstate them with back pay, he was not bound by the closed shop contract.

Court Backs Right To Drop Sluggard

The Federal Circuit Court of Appeals overruled an order by the NLRB directing the Sheboygan Chair Company to reinstate with back pay a discharged employee. Judge Minton remarked that, in his opinion, although the trial examiner recommended dismissal of the complaint, the Board persisted in its efforts to enforce its order. "The undisputed evidence shows that the employee was non-cooperative, that he did not do his share of the work, and that he was always complaining to his fellow employees. Further, the employee would not even cooperate in the affairs affecting the union seeking now to protect him."

Employer's Right Not To Bargain

Where the Labor Board has not determined the appropriate unit, the employer's refusal, in good faith, to deal with the union except on the basis of what he considers the appropriate bargaining unit is not an unlawful refusal to bargain. In the particular case, the employer was willing to make an agreement with the union for its members only in a two-plant unit for which the union did not claim a majority status. The union insisted on an exclusive-recognition contract in a one-plant unit, where it claimed a majority of the employees as members. (Bonafide Mills, Inc.)

Duties of Management

1. *To make effective the disavowal of anti-union attitudes.* Management may be neutral in its attitude as between labor organizations and make that attitude apparent to its employees. This is not enough unless it also compels the supervisory staff to observe such neutrality. In determining management's neutrality the test is the effectiveness of the employer's notice of such neutrality. A mere bulletin board notice professing neutrality, together with instructions to supervisors to observe neutrality, is not considered effective disavowal in view of findings that the instructions were not obeyed. (NLRB vs. Aluminum Goods Manufacturing Company.)

2. *To embody present practices and lawful duties in contract.* However, the Wagner Act does not compel the making of agreements or the acceptance of any particular terms, the parties being left free to use their economic strength in all lawful ways to persuade the other side to make

(*Continued on page 202*)

Roller Reception Speeds Parts Inspection

Fewer people, easier work, less confusion, since Gemmer installed a roller conveyor that carries incoming materials from truck platform to inspection benches

CHARLES B. GORDY, Detroit Editor, *Factory*

Testing equipment is located on the tables, or in drawers attached to them, so that inspectors have only to move from one position to another to start a new job. A materials mover shifts the boxes

NO LIFTING. No dragging stock boxes about the floor. No walking around looking for work. No searching through a pile of boxes. Roller conveyors have revolutionized the handling of parts and supplies in the receiving department at Gemmer Manufacturing Company, Detroit. Everything is now at working height. All materials are visible. Six girls and one man are doing the work that formerly took ten girls and two men.

In the old plan material had been received by truck. As a matter of fact, under the new plan it is still received by truck, but in an entirely different way. In the old plan, the big doors affording access to receiving department were opened and the vendor's truck was backed into a floor level vestibule at one end of the space devoted to receiving material.

The vestibule was large enough to permit unloading the trucks before the inner doors leading into the receiving department were opened. When the unloading was completed, the trucks were driven out of the vestibule, leaving the unloaded containers in a pile on the floor. The inner doors were then opened, and the containers picked up from the floor and moved by hand truck to be opened at the location marked "box-opening space" in Figure 1.

In winter a blast of cold air would enter and cause discomfort not only to the twelve people doing the receiving, but also to the machine operators in the immediate neighborhood. Also, the heat loss tended to disrupt the balance of the entire plant.

Another serious defect in the old plan was the amount of handling necessary. Boxes were taken from the trucks and placed on the vestibule floor; they were then picked up and moved to the box-opening space and opened. If a scale count was to be made, the boxes were wheeled to sunken scales and then, after the weighing, to any available open space in lines of boxes kept on the floor waiting inspection. In addition to the high cost of this method, stooping and lifting made the work unduly severe for the workers.

Some inspections are 100 percent, others 10 percent. In either case, the lines of boxes or vendors' containers on the floor of the receiving department had to be shifted around to line the material up for inspection. It is perhaps evident that lack of space would frequently cause containers in one order to be placed at different places in the box lines. This, also, caused considerable shifting about to get at a complete order, or to secure

a 10 percent sample from each box in each order. Two husky men with hand trucks were required to do this lifting and to deliver boxes to the inspectors' benches. At times the girl inspectors would have to locate the proper box, take a scoopful of its contents, and walk some 50 feet back to their inspection benches.

This lack of flexibility resulted in a great deal of confusion and waste effort, especially on days when receipts were heavy. Not only did the old plan result in waste effort and lost time for the inspectors, but also sprains and injuries, caused by falling over the boxes piled on the floor, were not uncommon. Sometimes boxes of material would get covered up and temporarily lost. The confusion that resulted because inspectors and material handlers were working in the same narrow aisle, was trying to tempers.

The effort wasted by this plan is obvious. Anyone familiar with conditions as just described will recognize that the orderliness displayed in Figure 1 is more apparent than real—the rows of various sized boxes and kegs piled on the floor were certainly not as orderly as a drawing looks.

The first step made in revising these conditions was to transfer truck unloading to the outside of the plant. Trucks now back up to a section of gravity roller conveyor placed at the same level as the truck floor. Boxes enter the receiving department on this conveyor and through an air lock, 24x30 inches, placed in the sidewall of the building. The outer door of the lock swings shut before the box forces the inner door up—cold air entry is thus eliminated.

Boxes on the Move

Boxes continue down a roller conveyor (Figure 2) past the receiving clerk's desk. If a scale count is to be made, boxes are opened, pushed to the end of this line, and dumped into a fixed hopper through which the parts run into out tote boxes. (Under the old plan, if a scale count had to be made, this dumping into the pans was done by hand from boxes or kegs on the floor.) There is no lifting, and effort is reduced to a light push over the antifriction-bearing rolls of the conveyor. A scale car, with a short section of roller conveyor as its platform, is then rolled to the short transverse section of roller conveyor under the hopper, the tote pan is pushed on the scale, and the count taken.

Tote pans can then be elevated by the mechanism on the scale car and transferred to any of the five lines provided—to be inspected or to be stored.

The scale car can be used to shift pans from the hopper to any line, but a faster and more flexible way is to use the ½-ton electric hoist that runs over the ends of all lines, including the dumping hopper. Specially designed scissor arms engage the ends of the tote pans to make the transfer both quick and safe. One man operates this hoist by controls dropped from the elevating mechanism.

If parts are not to be scale-counted, the containers are pushed from the rollers adjacent to the receiving desk to the parallel roller line. From this line boxes are shifted to any one of the remaining lines by the connecting end section conveyor—either to be inspected at once, or to be stored temporarily while awaiting inspection.

All roller conveyors are 18 inches wide and 32 inches from the floor. Steel sheets, ⅜ inches, with angle iron reinforcements on each edge, are

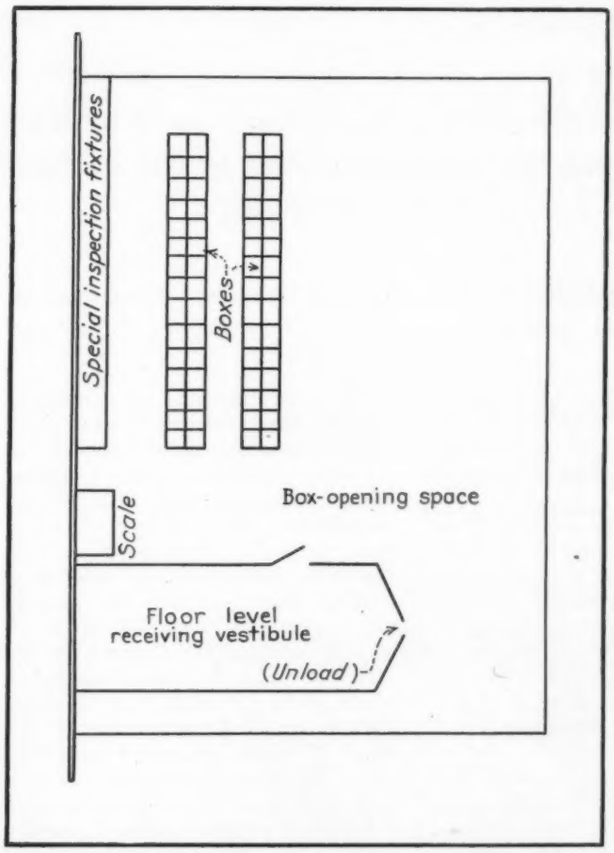


Figure 1. Although it looks neat enough in a drawing, the old layout was confused and untidy

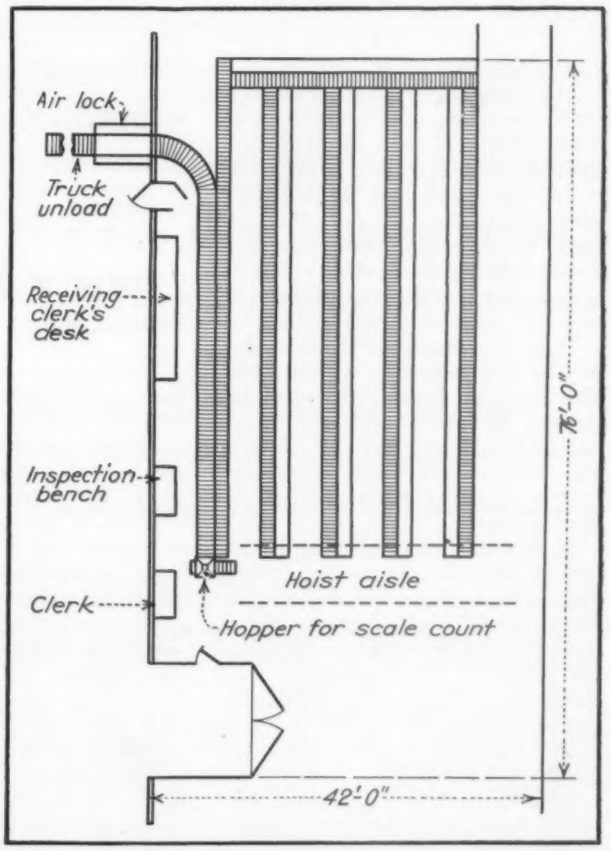


Figure 2. Roller conveyors do all the heavy work in the new plan of receiving incoming materials

bolted flush with the roller conveyors. These tables serve as storage and work areas, and as means of shifting boxes about to secure particular orders for inspection in accordance with the assembly schedule in the operating departments. They serve also as work tables for the inspectors. Aisleways between lines are 40 inches wide.

In the old layout, sometimes the inspector would locate the correct box and carry a scoop of parts back to her inspection table; then she would go to the gage cabinet and get the proper testing equipment—all told a walk of some proportions. With the present arrangement, testing equipment is located on the tables, or conveniently in drawers attached to them. It is only necessary, therefore, for the inspector to shift from one inspection position to another to start a new job—a matter of a few feet. In the meantime, the one material mover shifts the boxes to the correct inspection position through orders of the chief inspector. Actually the shifting could be done by the girls, for no great effort is involved.

Lights over the inspection lines provide additional flexibility—each light can be shifted several feet horizontally. Thus the inspection point can be moved to correspond more adequately with specific requirements. There is a vertical adjustment also, to accommodate the needs of the inspector and the work to be inspected. The light fixture is attached to a tube which can be moved up or down in a sleeve connected to the outlet; a setscrew adjusts the fixture to the desired position.

Perhaps a glance at the two sketches will be sufficient to indicate the greater convenience of the new layout. Although a small saving was made in floor space, for practical purposes the two plans occupy the same floor area.

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Address the Editor

War Industries Face New Hazards

Chemicals new to a plant's experience, production stepped up past the safety point, fatigue caused by long hours—all among the hazards against which wartime industry must constantly be on guard

LEWIS E. MacBRAYNE, General Manager, Massachusetts Safety Council, Inc., Boston

MAN-HOURS and more man-hours are a primary need in wartime production —and the worker who is unable to be at his machine because of accident or illness is certainly failing to do his all to increase production of airplanes, guns, tanks, ships, or any other war need. Whether the illness or accident occurred during his working or his off hours makes no difference to the main issue—he is holding back production.

There are hazards in all industry—but in war industries hazards may have increased because the plant has changed its product from the regular line to something that the Army or Navy requires, which can be prdouced largely by the equipment that the plant possesses.

Among the increased hazards that may be attributed to wartime production are the introduction of potentially dangerous chemicals new to the plant's experience; stepping-up of a hitherto safe process to the point where it becomes hazardous; lowered vitality caused by fatigue because of long hours and overtime work, and consequent inefficiency.

There are 41 toxic substances commonly used in industry, beginning with ammonia and amyl acetate and ending with xylene and zinc oxide fumes. Tables are available to show the concentrations that should not be exceeded. But the production man on a wartime contract need concern himself only with those that are involved in his own problem.

If he is using radium in airplane instrument dial painting, he has something to watch, and need of expert advice from the beginning.

He may find his dust count becoming greater under increased production and discover that minor explosions that do no serious damage are beginning to occur. These warnings should not be disregarded.

The disposal of magnesium files, chips, or shavings is a matter sometimes neglected in the rush of heavy production. These particles get into workers' shoes or trousers, and have been known to ignite.

The rapid expansion of the aircraft industry has developed hazards that are not always recognized in the beginning. Tri-chlor-ethylene is extensively used as a degreaser. It is efficient and effective, but is a hazard when not used correctly. Precautions require that tanks have a sufficient number of cooling coils, and that the cooling water is really cold, so that vapors are condensed before the escape from the tank. The tank itself must be located where it is not exposed to a draft. Otherwise such a draft of air will create a vacuum at the top of the tank which will draw the vapor out.

In cleaning the fuselages of aircraft on the inside, where carbon tetrachloride is used, there is danger of asphyxiating the worker in the small space of

(*Continued on page* 196)

Scheduling the 168-Hr. Week

Eight hours on, 24 hours off. Four men keep three machines operating continuously. No one works too long. All get the same amount of overtime in each period

R. R. LYMAN, The Gray Chemical Company, Roulette, Pa., and D. P. OTHMER,
Professor of Chemical Engineering, Polytechnic Institute of Brooklyn

A WORKING SCHEDULE for 7-day, full-time operation of a factory which provides exactly the same conditions for all workers and gives each man 5 full days of 24 hours off each week has been in successful practice for over 4 years at the plant of The Gray Chemical Company, Roulette, Pa., a well-integrated modern wood distillation plant manufacturing charcoal, refined acetic acid, various grades of methanol, activated carbon, and rough and finished lumber. The novel plan is really based on the substitution of new time units for the usual ones—instead of a 24-hour day, a 32-hour cycle (four 8-hour shifts); instead of a 7-day week, a 4-day rotation; and instead of a calendar month, four weeks (28 days of 7 rotations) which period acts as a common denominator of days, shifts, cycles, and weeks.

In operations requiring 168 hours of work per week, scheduling is usually done with four operators, one of whom must always be at the post. On equal division of time, each worker must spend one quarter, or 42 hours per week. The problem is to allot time to treat the four men fairly and have the minimum disadvantages in changing schedules. Habits, outside activities, sleeping considerations, wage-hour laws, and many other factors must be considered.

The Gray plan of progressive-rotation follows the simplest possible pattern. A man works 8 hours, is off 24 hours, and repeats indefinitely without change. Thus out of 32 hours, A is on 8, off 24, and tends the post one quarter of the time; B takes over at the end of A's shift and then is also always on 8 hours and off 24; C follows B identically, and D always follows C to complete the cycle. There are never any "shift changes"—every man's lot is always identical, and they all never fail to "progress" and "rotate" consecutively.

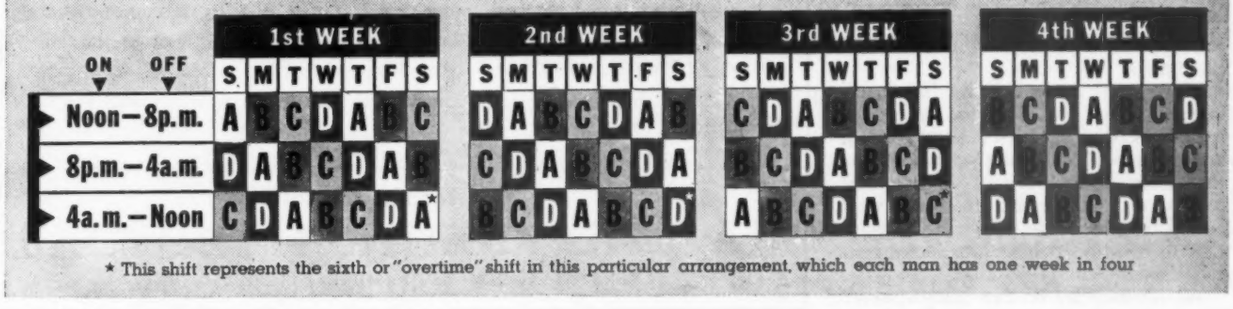
Since there are 3 shifts of 8 hours per day and 4 of these shifts in the 4-man cycle, at the end of 4 days the rotation is complete, and every man starts his shifts at the same hour as he did the first day; and each man

(Continued on page 200)

ADVANTAGES OF GRAY SHIFT SCHEDULE

1. Every man always has at least 5 full 24-hour periods off every week
2. No relief men are required
3. Every man always has three out of four Sundays off, and three out of four of every other weekly recurring time
4. No long shifts *on* or short periods *off* and no weekly change of shifts with accompanying disruption of sleeping habits, barely acquired from last change
5. Every man may have *off* at least half of the day time every day, and desirable sleeping time every night
6. The simplest possible pattern; no printed schedules necessary
7. Overtime reduced to theoretical minimum and bookkeeping minimized
8. Same men always work together every day
9. Supervisors see every man at least every four days
10. No man ever works over 8 hours in any calendar day or consecutive 32 hours

SAMPLE SHIFT SCHEDULE OF GRAY PLAN


1st WEEK
2nd WEEK
3rd WEEK
4th WEEK
ON
OFF
S M T W T F S
Noon—8p.m.
8p.m.—4a.m.
4a.m.—Noon
A B C D A B C
D A B C D A B
C D A B C D A*
D A B C D A B
C D A B C D A
B C D A B C D*
C D A B C D A
B C D A B C D
A B C D A B C*
B C D A B C D
A B C D A B C
D A B C D A B

* This shift represents the sixth or "overtime" shift in this particular arrangement, which each man has one week in four

MANAGEMENT SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

In four minutes flat, by a photographic process developed at Glenn L. Martin Company, Baltimore, drawings up to 5 by 10 feet are reproduced directly on nearly any kind of surface—metal, wood, cloth, paper, or glass. Here, to illustrate one of many applications in aircraft assembly, a detail has been photographed directly on duralumin, and an experimental or small-quantity part is sawed out

•

Accident Prevention By Committee

F. W. STEIN, Works Manager, The Standard Register Company, Dayton, Ohio

In a plant such as ours we have not found it necessary to employ a safety engineer. We handle our safety problems by setting up an accident prevention committee composed of three groups: (1) Selected employees, (2) all foremen, (3) certain plant specialists whom we call assistant chairmen.

For the first group we have 200 people to select from who have had specialized Red Cross training in first aid and accident prevention. These employees demonstrated their interest in safety and accident prevention to the extent that they went out on their own time to get this training. One to two thus trained are selected from each department.

All foremen are on the safety committee. This assures prompt action for the removal of unsafe conditions.

Plant specialists whom we call assistant chairmen compose the third group. They were selected because of their knowledge of certain plant problems quite beyond the control of the foremen. This group consists of foremen who have a special knowledge of fire prevention, good housekeeping, first aid, safety devices, office problems, and traffic.

It is the duty of the committee man from any one department to take up all problems immediately with his foreman. We do not wait until the monthly meeting to discuss the merits of individual problems. This leaves the program open for the discussion of some general topic led by the assistant chairman such as use of fire extinguisher, traffic problems, or proper use of guards for machinery. If we have a problem beyond the department head's control, it is turned over to the general chairman who in turn sees to it that the proper specialist handles the job. If traffic lines are needed, the traffic chairman handles it. If fire extinguishers need to be relocated, the fire prevention chairman handles it. Maybe some foreman is having trouble guarding a machine; the safety device chairman is immediately available to help him.

We believe that most shop committees break down because they are not sold on safety. We try to do a selling job. We pass along information on safety devices, new equipment; have meetings on general subjects, such as the detailed operation of our sprinkler system, the proper use of fire extinguishers, traffic and trucking problems, mechanical safeguards, first aid activities. At the monthly meetings notes are made and sent to each member. Our main object is to keep members informed. Keep them interested and we can collect the dividends of accident prevention.

One other angle to Standard's plan was

(*Continued on page 232*)

Management, How Good Is Your Control?

Ask yourself these questions to check up

18. PARTS STORAGE

1. Are there enough racks? Or are there too many? Is rack space economically used?

2. Are racks located in proper place in parts flow? Are shelves clearly marked for "ponies" to sort into? Is "pony truck" aisle kept clear at all times?

3. Do "ponies" understand clearly how to sort incoming orders into racks?

4. Are parts stored neatly in racks? Or are they thrown in haphazardly?

5. Is rack space broken down by machine number? By part number? By assembly number? By lot number? Or by ship number? Or do you group all parts of an assembly together in racks? Which ties in best with production schedule?

6. Are racks inspected several times daily to keep "past due" orders moving?

7. Are large parts stored on lower shelves? Small parts on upper shelves?

8. What provision is made for storing parts which are too large for racks? Are rack shelves properly spaced? Should some be farther apart?

9. Are jigs stored alongside proper part? Or in separate sections?

10. Are top shelves of racks kept clear and clean? The floor underneath?

11. Is "schedule day" clearly posted on rack? Changed daily?

12. Are shop orders placed in racks with parts? Or filed in order box on leader's desk?

13. Are racks clearly marked "Incoming," "Outgoing," etc.?

Next Month: Output

Prepared by HARDING PALMER, *Industrial Engineer*

Lockheed Aircraft Corporation, Burbank, Calif.

MAINTENANCE SERVICES

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

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FACTORY MANAGEMENT AND MAINTENANCE

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

MAINTENANCE as the Editors See It

Little Sparks Can Start Disastrous Fires

A TINY SPARK, according to reports, fell on flammable material and started a fire that raged for hours. Now one of the world's greatest ships lies on her side, on the muddy bottom of the Hudson River. Thus runs the sorry saga of a recent catastrophe that caused nation-wide dismay.

If current beliefs are true, a bit of molten material, comparable in size to the head of a pin, did what torpedoes and bombs might not have been able to do.

Little flaming missiles are produced in countless numbers whenever cutting and welding are done, but the record of fires started by them shows frequent failure to realize how dangerous they are. Precautions that ought to be taken during welding and cutting operations have been carefully worked out and should be well known. For example, provide proper supervision; put fireproof covers over flammable materials; keep sprinklers in service; don't weld or cut in the presence of flammable dusts, gases, or liquids; post men close by with hose, extinguishers, or pails of water so that any blaze can be quickly doused.

These are some of the essential precautions that apply to every cutting or welding job out in the plant.

In welding and cutting equipment, industry has an indispensable tool but it must be recognized that use of such equipment around the plant may involve serious fire hazards.

The white-hot sparks that are given off in such abundance are potentially about as dangerous as an incendiary bomb, and can do plenty of damage unless adequate precautions are taken.

Failure to observe these precautions is literally gambling with fire—something that no plant executive should do.

Manhours Can Be Lost in Many Ways

AVOIDING LOSS of manhours by minimizing failures of equipment is the big job of maintenance. And it's a man-sized job, no matter how one looks at it.

Pre-occupation with the vital matter of keeping equipment running 24 hours a day should not blind anyone to the fact that failures of machines or equipment are not the only source of lost manhours. Machines must be kept going, of course, but it is also important to prevent manhours from being lost for other reasons. Time lost is time lost, regardless of the conditions that brought it about.

For example, the slippery surface that causes a fall and sprains an ankle or breaks an arm; a leak in the roof that wets machines or work; a rough, bumpy floor that slows down truck traffic; inadequate or inconveniently located sanitary facilities; variable-speed drives that do not fit the need—all these and many other conditions can cause manhours to be lost just as surely as when some piece of equipment fails.

It's up to maintenance to plug all the little sources of loss as well as the big ones.

War Work Brings Up New Problems

CONVERTING A PLANT from peacetime to wartime production frequently is much more than a matter of re-tooling some machines. There may be no use for some machines and equipment. Other machines not previously used may have to be installed. Power loads may be considerably increased in certain departments, decreased in others. The same thing is true of water, steam, other services. Usefulness or importance of the kinds of materials handling equipment previously used may become greater or less.

All such things must be taken into account by the maintenance department and carefully considered from several standpoints. There is, for example, the matter of bottlenecks, and the strategic importance of facilities and equipment.

Good maintenance executives know the danger spots in their plants. They know which motors, conveyors, and so on will cause the most serious interruptions if trouble develops. With this knowledge they can plan to keep the necessary spare units and parts in stock, so that breakdowns can be handled with the minimum delay.

In the rush of getting a plant into full swing in the production of things that are new to it, there will be ample opportunity to forget the necessity of re-appraising the importance of every department and piece of equipment. It may well be found that old bottlenecks have disappeared, to be replaced by new ones elsewhere. Hence, inspection schedules and stock-keeping practices may have to be radically revised in order to meet the new set of conditions.

Reliability of the supply of power and other facilities, both for the plant as a whole and for important departments, ought to be considered and improved if questionable.

A changeover to war work may easily bring about new conditions and problems that maintenance should study very carefully.

How to Get the Most From V-Belt Drives

To get the most out of equipment is good sense at any time. Now it is also a duty. Here's down-to-earth advice on how to install and care for V-belt drives so that they give full measure of the service that is built into them

C. O. MITCHELL, Research Engineer, L. H. Gilmer Company, Philadelphia

Here's what happens when belts run too loose. Belt stalled, motor sheave turned, and belt was burned because of friction that resulted

To DO THEIR JOB satisfactorily and give added years of service, V-belts must be properly installed. The procedure is simple, and can be broken down into four steps as follows:

1. *Alignment.* Sheaves should be checked to see that they line up in at least two directions. Shafts should be parallel and grooves should be in line with each other. Fortunately for the user of V-belts, they will perform even if they are badly out of line, but their life is cut from one-third to one-half.

2. *Move Motor Back When Installing Belts.* Moving back the motor or even the driven unit in cases where the drive unit is fixed, is also of prime importance. It is then easy to put the belts in their proper grooves with no danger of injury.

3. *Tension.* This question of tensioning V-belts has always been a difficult one to set forth properly in words, to cover any possible combination of sheave diameters, shaft center distance, and V-belt cross-section. Naturally, the proper tension can be calculated, and if it were always possible to measure this tension as the motor is moved out, it could be made absolutely correct. However, for all practical purposes this simple rule should be followed: Tighten the belts by moving the motor or other unit until it requires some effort to twist a strand of the belt a quarter turn, grasping it with thumb and fingers of one hand. This will indicate when the condition of good belt tension has been reached.

4. *Check Drive After Two or Three Days' Operation.* All V-belts have a certain amount of stretch and a period of run-in time during which they seat themselves in the grooves and elongate slightly. After this has taken place, which requires two or three days on most drives, belts must be re-tightened to give good performance.

Things Not To Do When Installing V-Belts

1. Do not pry V-belts on the sheave grooves by screwdrivers, crowbars, and the like. They may go on, but the internal cords will be injured, causing early failure. A well-known tool manufacturing company was continually buying a set of belts of a particular size and complaining of only a few months' service. Upon investigation it was found that the mechanic applying the belts always used a screwdriver to install them, because they were too short to go on properly. The proper method was explained and the next longer length used. The drive then functioned for years.

2. Do not "ring" the belts on from one groove to another. This also will injure the belt, because of the sharp bend where the belt goes from one groove to the next.

3. Do not let belts run too loose. Be sure to take up the slack when the slack side sags considerably. There is danger that the belts may be stalled when the unit is started. When V-belts are stalled and the motor sheave turns with the belts standing still, belts quickly burn up because of

the tremendous friction that results. Unlike flat belts, they cannot readily run off the sheaves.

A well-known refrigeration unit manufacturer experienced a great deal of trouble with burned belts on one model. Investigation brought out two reasons: The belt was running too loose; the motor sheave was too small, which caused a low belt speed, resulting in a reduction of the belt's capacity to transmit power. Both these conditions were corrected, and further trouble was eliminated.

Changing to V-Drives

When it is desired to change to V-belt drives it should be remembered that in general belt speeds should be kept at 1,000 fpm or over. Sheave diameters should be kept at or above the minimum recommended for the belt section.

A small pump manufacturing company was having trouble with one of its units. Belt life was a matter of weeks. The entire trouble was a combination of small sheaves and slow belt speed, well under 1,000 ft. per min. The design was changed so that a larger motor sheave could be installed, which accomplished two things: (1) A larger sheave was used; and (2) a higher belt speed was obtained, thus increasing the horsepower transmitted. No further trouble was experienced from this cause.

Such situations need never occur if attention is paid to keeping sheaves at or above the minimum diameters and maintaining belt speeds over 1,000 feet per minute.

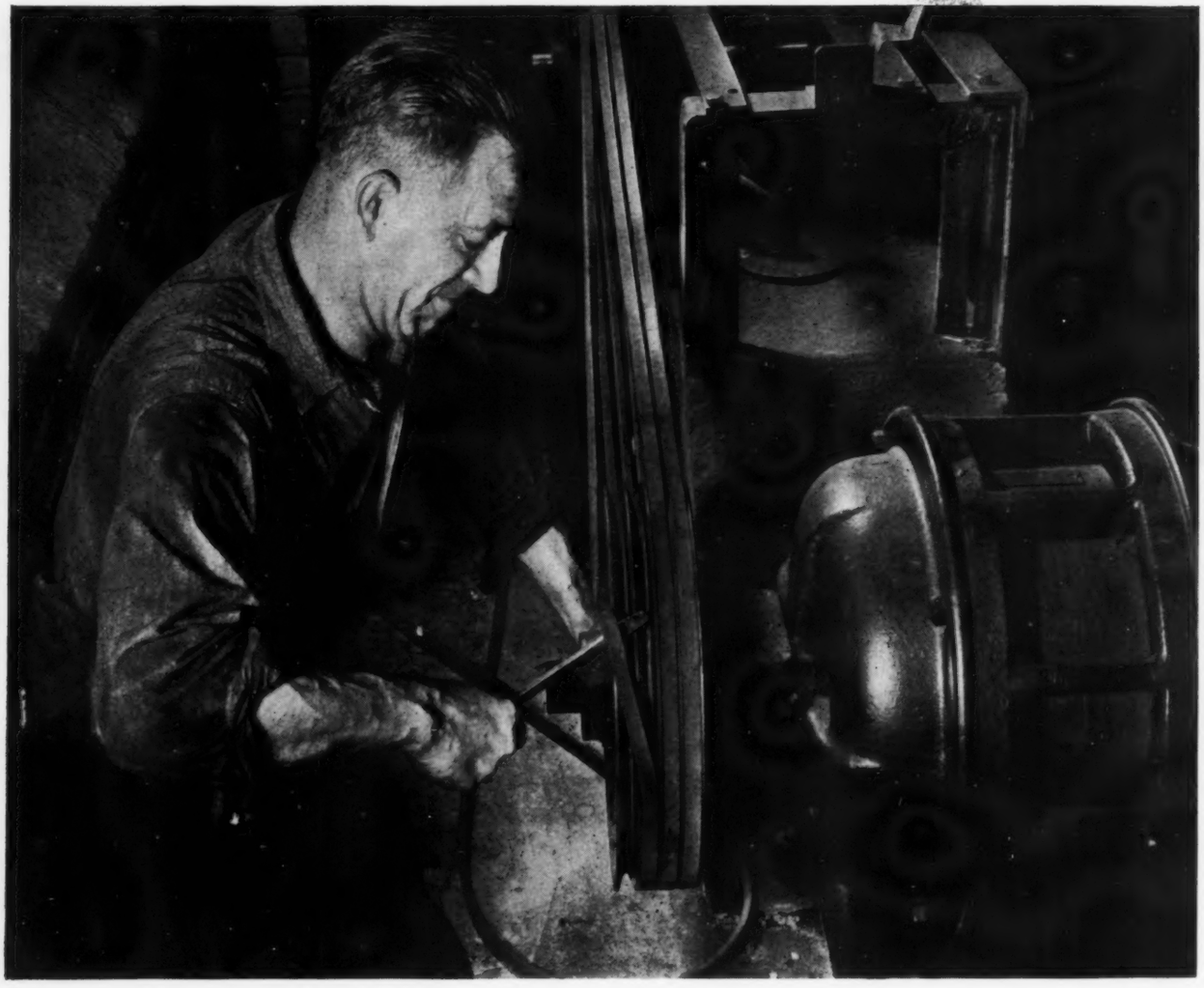
Many drives can be economically changed over to V-belt drives by designing the drive so that the V-belts ride on the flat driven pulley. Such a drive is known as a V to flat drive and may be employed whenever the speed ratio between the drive and driven shafts is greater than 3 to 1.

Such a drive should always operate on short shaft-center distances. For best performance the shaft-center distance should be less than the diameter of the large flat pulley so that sufficient "wrap" or arc of contact is obtained. This results in a conservation of the space necessary for the drive. In many instances additional machines have been installed in the space where the old drive operated.

Special Problems

1. *Oil or Grease.* Many V-belt drives are used today, whose life could be materially improved by using belts designed to perform under oily or greasy conditions. These belts are made of synthetic rubber. They may be obtained in all standard cross-sections and lengths usually at a slight additional charge. Belt life is

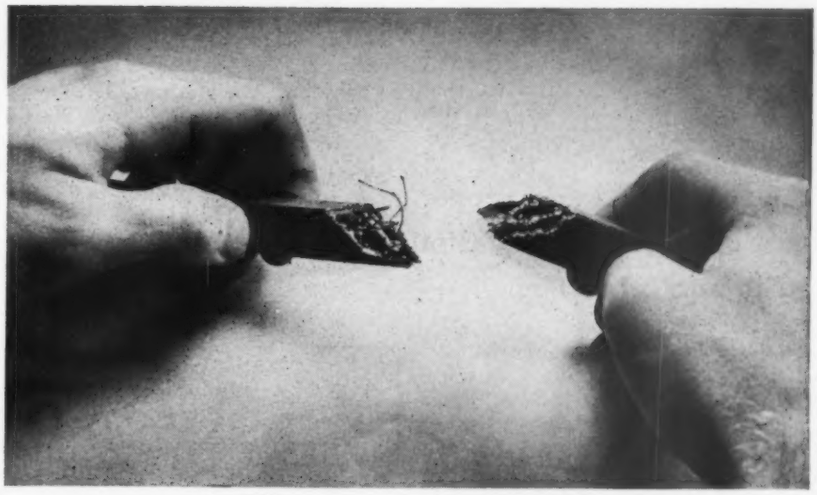
How not to install V-belts. Prying with screwdrivers will get them on, but internal cords will be injured



sometimes doubled or even tripled by using oil-resistant belts, which more than pays for the difference in cost.

2. *Heat Condition.* Whenever an excessive heat condition (temperature above 130 degrees Fahrenheit) exists, it is possible to improve the life of the belts by replacing regular rubber belts with a set of heat-resistant V-belts. These belts are also available in all standard sizes with usually a small additional charge. They also are made from a synthetic rubber, and operate satisfactorily in temperatures up to 200 degrees Fahrenheit.

3. *Static Generation.* Where the drive and driven units are not sufficiently grounded, the generation of static charges sometimes results. In some places this condition may be serious. There are two ways of eliminating this trouble. One is the installation of a static collector, which grounds out the charges. The other, and less expensive method, is to install static-dissipating V-belts in connection with a ground on one machine.



Prying or ringing belts on sheaves results in destruction of internal cords—and a much shortened belt life

"Ringing" injures the belt because of the sharp bend where the belt goes from one groove to the next

How to Conserve Tools

Disston fights misuse of tools, waste of material and time, by distributing, free, cards showing how to select, use, and take proper care of 35 different kinds of saws and other items

A DEFINITE, well-conceived plan for conserving vital materials and speeding up production has been launched by Henry Disston & Sons, Inc. Designed to accomplish objectives that are of the utmost importance to the national welfare, the plan has the virtues of simplicity and easy applicability to every manufacturing plant.

The fundamental idea behind the plan is to instruct workers in the proper selection, use, and care of tools. Need for such instruction is pressing and constitutes a weak spot that must be eliminated before the goal of maximum output from men and machines can be realized.

A great many now engaged in war work had not previously been in industry, or were formerly engaged in totally different pursuits. These workers have not had time to acquire the fundamental knowledge of tools that an efficient workman must have. Without that knowledge excessive breakage of tools, spoilage of stock, low production rates, poor workmanship are inescapable.

Time Is Limited

Proper supervision will do much to make up for that lack of knowledge, but there aren't enough supervisors available. The amount of time that can be spent in instructing green hands in basic details, to say nothing of fine points, is rigidly limited. Therefore a worker may have to learn largely by experience, making mistakes in the good, old-fashioned way—for which the employer and the nation pay.

Attacking this problem right at its source, Disston's Conservation Control Plan, as it is called, revolves around a series of 35 handy-sized instruction cards, one of which is shown here. Each card deals with a specific tool. On the front are listed the possible faults in operation, common difficulties, and usual mistakes in practice, with the proper methods of correction.

On the back of the card is given all information on tool design, speeds, and feeds needed to select the tool properly for the work in hand.

It is intended that workmen be given the necessary cards by their foremen, with a word of explanation as to how the cards should be used and what they will accomplish. Cards will be supplied free to all users of tools regardless of make.

To stimulate interest in the plan and secure full cooperation by workers in promoting its basic purposes, promotional material will also be supplied free. It includes posters to be placed on bulletin boards, stickers and lapel buttons. All these items bear the emblem symbolizing the plan. They also carry the slogan: Conservation Serves Everyone.

CONSERVATION CONTROL CARD No. 3

Milling Saws

CIRCULAR—HIGH TEMPER

How to obtain greater efficiency and make saws last longer.

FAILURE	CAUSE	CORRECTION
Premature wear	Operating speed too high for material.	Do not exceed 60 ft. per minute for ferrous materials. See recommendations on other side.
	Feed too light.	Increase feed until chip is normal. See recommendations on other side.
Tooth breakage	Stock slipping or turning.	Inspect clamping device. Use V block to hold rounds.
	Saw slipping on arbor.	Always use key or tug pins. Do not depend upon collars for clamping.
	Saw chatter.	Overhaul gearing to remove backlash.
Blade breakage	Stock slipping or turning.	Clamp stock rigidly.
	Saw slipping on arbor.	Drive with key or tug pins.
	Hanging up in cut due to irregular feed.	Inspect feed mechanism. Overhaul or re-new worn parts.

(CONTINUED ON OTHER SIDE)

Correct use of tools . . . makes work easier . . . saves vital materials

Heart of the conservation plan is a series of 35 cards, each dealing with one tool. Information on proper selection is given on the back

Calco began by teaching the teachers. Here, a pipefitter instructor on the job with two learners

Training for Maintenance

R. C. OBERDAHN

Director of Training, Calco Chemical Division, American Cyanamid Company, Bound Brook, N. J.

QUICK TRAINING for machine operators and other production workers is an accomplished fact. Many short cuts have been made in this type of training. Good operators are being turned out in quick time.

This is all to the good. These men are needed in the manufacture of guns, tanks, ships, and planes. They are of prime importance because they are the ones who really produce.

But how about some other men we don't hear much about, but who are just as vital as the production workers to the success of our war program? I mean the craftsmen in the maintenance department — pipefitters, millwrights, electricians, tinsmiths, blacksmiths, welders, lead burners.

About a year ago our division, like many other plants in the manufacturing industries, began to feel the pinch for trained mechanics in all branches of maintenance work.

There were several things that could have been done. We might have waited until the situation got critical, and then called on the government for help. Or we could have gone out and offered more money for maintenance mechanics than the other fellows were paying. The first would not have brought us the men we needed. The second would have created an uneconomic wage structure. Both were unpatriotic.

There remained another way out. It was *get busy and find some way of training these men in the shortest possible time.* It was the alternative we adopted.

When the management gave the go-ahead signal for such a training program, the following questions arose: Whom to train? How and where to train? What to teach?

These are questions that must be asked when any training program is set up. How we answered them in setting up our maintenance training program for pipefitters, millwrights, and electricians—how, one year after starting, 12 men out of the 46 starters have already been promoted from the helper-learner to the mechanic class—is briefly described in the pages that immediately follow.

Whom to Train

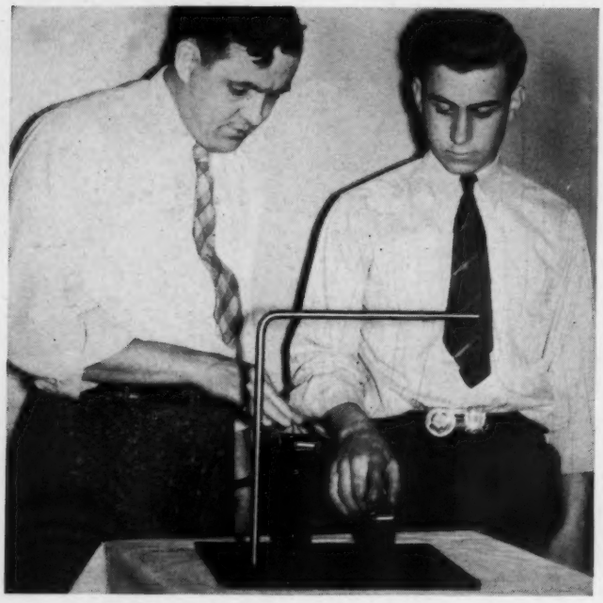
NOT TOO HARD a question for Calco to answer. It had always had a helper system in the maintenance shops. Many of these helpers had picked up enough knowledge to qualify as lower-grade mechanics. But no sustained upgrading effort had been made.

It was natural to begin with the helpers. Some of them had already studied blueprint reading and shop mathematics in Calco's evening school. To get the best men, mechanical aptitude, mechanical comprehension, general intelligence, and arithmetic achievement tests were given.

Three shops were used as a starter—pipe, millwright, and electrical. Twenty boys were picked from the pipe shop, 20 from the millwright shop, and 6 from the electrical shop. Students were chosen by shop foremen, on the basis of willingness to learn, willingness to cooperate, even temperament, and general attitude toward the company.

Many other boys in these three shops were nearly as good as the 46 who were chosen. These others will form the nucleus of the 1942 class.

Below are shown three of the battery of tests on whose results the selection of helpers for maintenance training was based.



Forty-six helpers from three maintenance shops were chosen. Boy is being given reaction-time test

Assembly test is one of a battery of tests that insure Calco's getting the best boys to train

Applicants take paper-and-pencil tests designed to reveal mechanical aptitude and general information

Maintenance mechanics employed as instructors were first given an intensive course in how to instruct

How and Where to Train

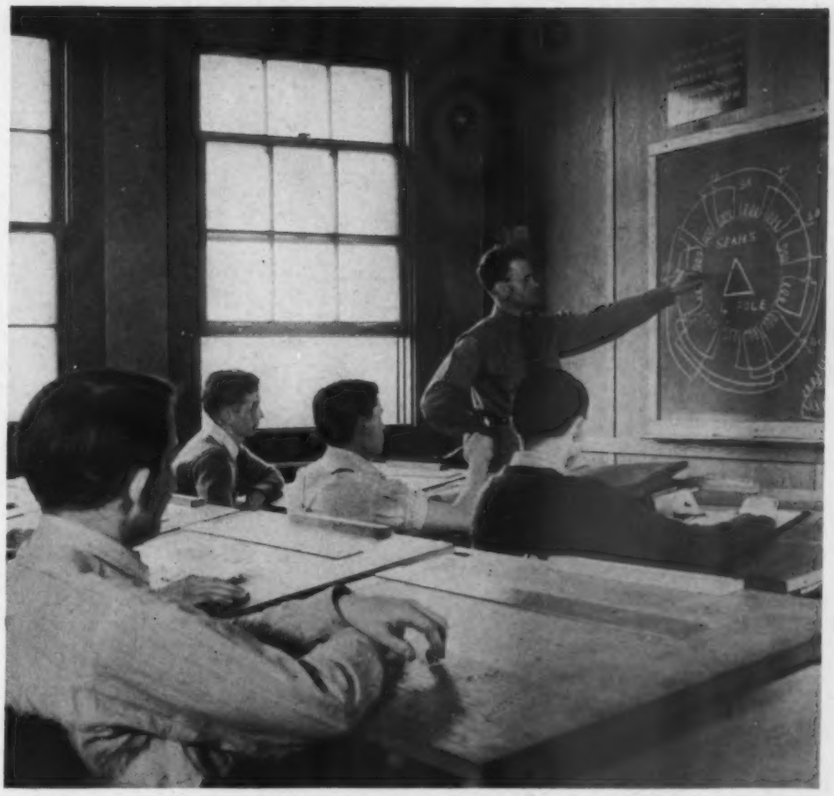
SEVERAL PLANS were considered. The vestibule system for one. Or bringing in outsiders to train the men. But the plan that seemed to be the most feasible was built around the idea of letting the mechanics on the job train their own help.

After all, after a boy is trained, he has to go out in the shop and rub shoulders with the mechanics. So why not let the mechanics out in the shop do the training?

A group of mechanics were therefore chosen who had established themselves as being able to get along with their helpers, and were classified as mechanic trainers, each being given two, three, or possibly four helpers. The idea was that the mechanic trainer would take these helpers and teach them how to do the job—right on the job.

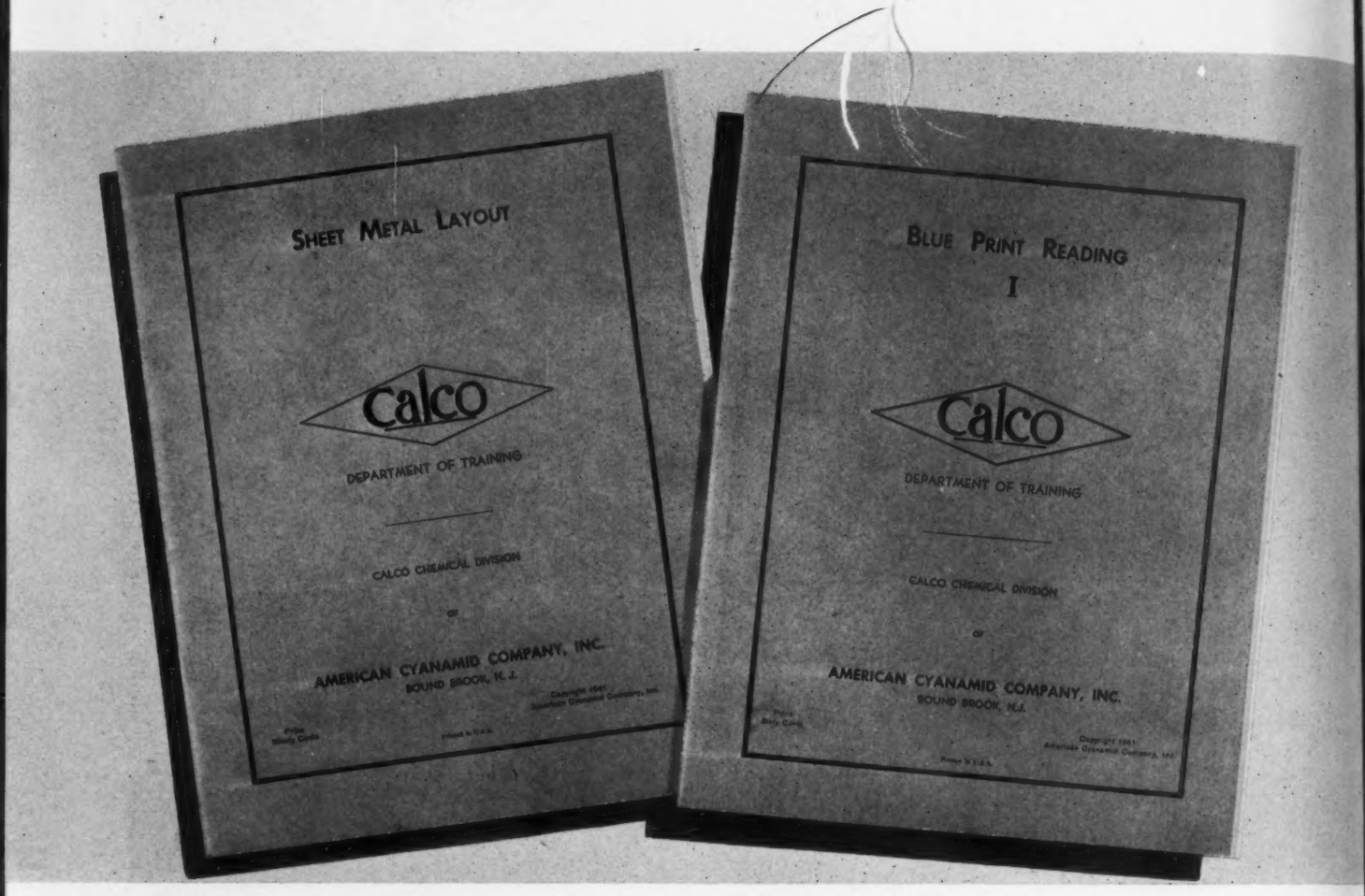
Well, you say, we know a lot of good mechanics whose attitude, fatherly instinct, and so on, may be all right. But still they can't teach.

Calco took care of this by giving these instructors a 10-hour course in how to instruct. This course was developed by the Training Within Industry Division of OPM, and is based on (1) preparation of the learner, (2) presentation of the operation, (3) performance try-out. (4) follow-up.



In addition to practical instruction from mechanics on the job, maintenance learners get classroom work—here, in electrical theory

What to Teach



Calco found it necessary to develop its own material for classroom work. Every learner is required to take courses in mathematics and blueprint reading. The text on sheet-metal layout anticipates extension of maintenance training to the tinshop. Training will be provided later on for other crafts

SURVEYS WERE MADE in each of the three shops. In the pipe shop, for example, it was found that a certain type of valve was changed a certain number of times; so many pressure gages were fitted; and so on. In this way the jobs done by mechanics in each of the three selected crafts were made a matter of record.

Here were the jobs listed one by one that an electrician, a millwright, or a pipefitter must know how to do. Courses were designed to give learners both the theoretical background and the practical experience needed in performing these specified jobs.

Some maintenance mechanics are naturally better qualified than others to do particular jobs. So, in order not to impair the efficiency of the organization, mechanics were always given teaching assignments that corresponded with the work they were especially qualified to perform.

Next question was how to convey this knowledge to the learners. Should they be taught one particular job quickly? Or should they be given the all-round knowledge of a first-class pipefitter?

Our answer was a progression-training program whereby the helpers would rotate from one mechanic to another. We not only rotated the helpers, but also never allowed two helpers to work together longer than one assignment. By splitting them up in this way, we got them used to working with different men under varying conditions.

As each man completed an assignment he was given credit in a book showing every operation he must finish in order to become a full-fledged mechanic. For each job a card must be signed by three people. The mechanic on the job signs to show that the learner is capable of doing the operation on which he has been training him. The foreman signs after an interview designed to show that the boy has learned that particular assignment. Last, the training coordinator—more about him later—signs after interviewing foreman, instructor, and learner. This rigid check-up has proved simple and effective.

Another question was what related material should be taught in the classroom. We found little had been written that we could use, so a mechanical engineer was called in to aid in the development of text material. Manuals were then prepared with the cooperation of various equipment manufacturers.

The instruction was divided into approximately 96 periods of two hours each. Learners attended school two nights a week.

All were required to complete the course in shop mathematics. This is

Learner learns how. Teacher is first-class electrician who has taken intensive course in how to teach

in four parts—arithmetic, fractions and decimals, shop geometry, and layout. At the start of each one of the four parts, a test is given. If the learner passes satisfactorily, he is excused from attending this part of the course.

For example, the first part of the course is devoted to plain arithmetic and its application to shop problems. We give a test; if the boy can pass with a mark above 85, he is excused. The next semester we take up fractions and decimals. Again the learner is given a test. Again, if he gets better than 85, he is excused. And so on, through geometry and shop layout.

Blueprint reading is also a requirement for all three crafts. This course is divided into two parts. Blueprint Reading I is divided into two semesters, twelve weeks each, two hours a week. If a boy can pass an examination at the beginning of this course, he is not required to take it, but is allowed to go on with Blueprint Reading II, an advanced 48-hour course in practical shop problems connected with maintenance work and new construction. Thus a boy starting from scratch must take four hours a week for 24 weeks in these two subjects.

We have also developed text material for electricians, millwrights, and pipefitters. The electrical course is divided into two parts—elementary electricity and advanced electrical theory. The elementary course includes brief discussion of electricity, what it will do, electrical units, symbols, laws, series and parallel circuits, carrying capacity of wires, wire circulation, fundamental principles of d.c. motors and generators, various types of motors and generators, electricity control and structure.

The advanced course for electricians takes up trouble shooting, wiring of motors, generators, line starters, etc.

A Two-part Course

Our pipe theory course is likewise broken down into two parts. The first is to give the learner a background in terminology; tools and equipment used; simple piping; theory behind steam, water, and acid; oil, air, and hydraulic lines. The advanced part is devoted to high-pressure steam and more difficult installations. (Our book on pipe theory has been used by a number of other concerns in their training work. Copies may be obtained by addressing the Director of Training, Calco Chemical Company, Bound Brook, N. J. Price $2.50 each.)

Millwright theory includes a practical study of physics, stresses, strains, installation of simple equipment, repairing and building of simple types of equipment. The advanced theory goes into installation and repair of more complicated equipment.

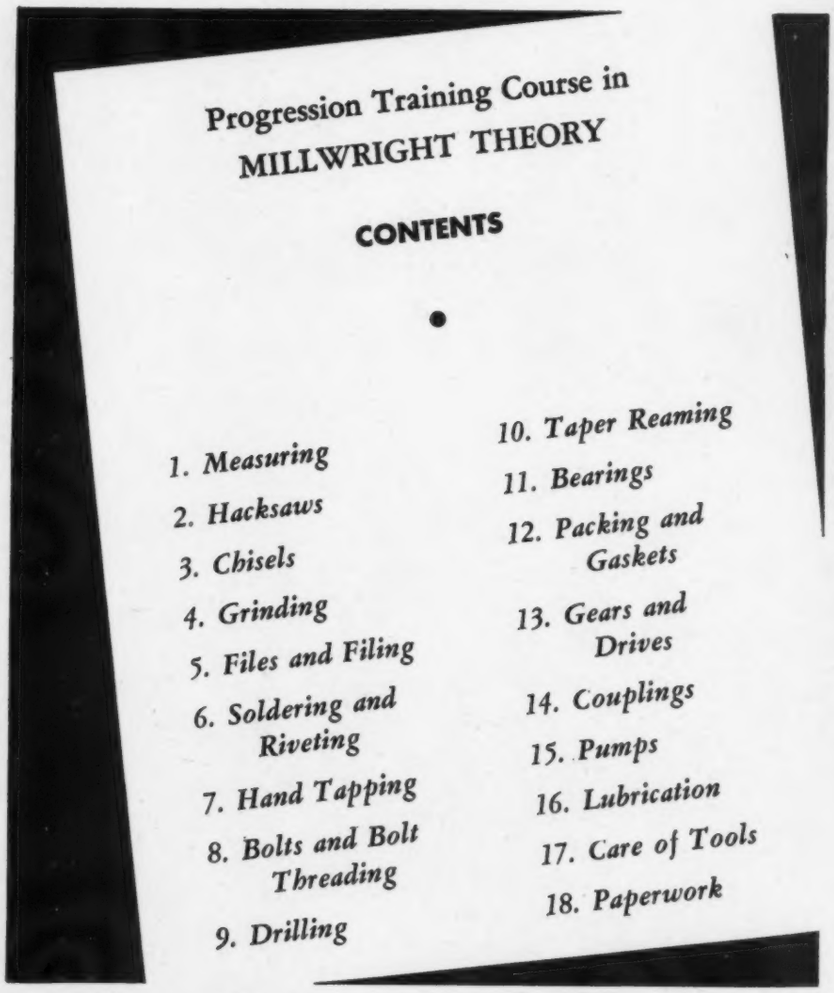
Elementary and advanced courses in all three subjects cover a period of two years—two hours a week, 24 weeks a year. This means that the boy spends seven hours a week in the classroom.

Calco's training coordinator happens to be a former baseball umpire. It is his job to see that the boys do not stay on one assignment too long. It is his job to check the learners on their classroom work. It is also his job to see that the learner, as soon as he has completed his course of instruction, is recommended for the next opening that occurs.

It is also the coordinator's job to see that tools are issued to these men on a part-payment basis. This means that, as soon as a learner becomes a qualified mechanic, he has a complete set of tools to take out on the job. It also means that during the training period he is not breaking the tools of the mechanic who is teaching him.

The entire program has been operated on a purely voluntary basis. The proposal is made to the helper. If he wants to take advantage of the chance to learn to be a first-class mechanic, he can. If he prefers to stay on as a helper, that is strictly up to him. Transportation problems or other educational works which the helper may be undertaking, may be good and sufficient reasons why he should reject the opportunity.

On the facing page, one of the more advanced problems that are handed out to learners in the pipefitting course. Each learner makes out an order for all materials needed, estimates time to do the job, tells how he would do it

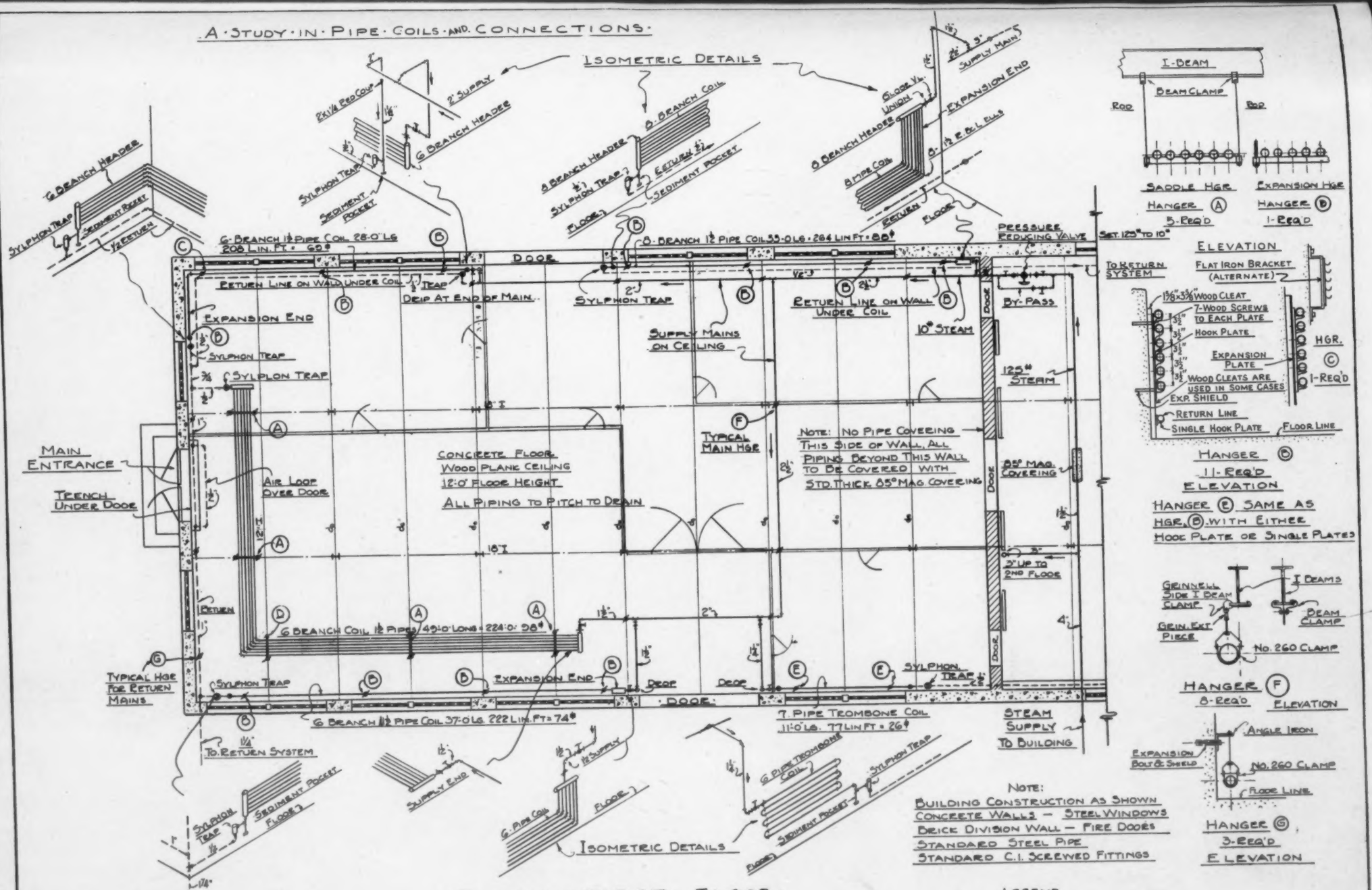

Progression Training Course in
MILLWRIGHT THEORY

CONTENTS

1. Measuring
2. Hacksaws
3. Chisels
4. Grinding
5. Files and Filing
6. Soldering and Riveting
7. Hand Tapping
8. Bolts and Bolt Threading
9. Drilling
10. Taper Reaming
11. Bearings
12. Packing and Gaskets
13. Gears and Drives
14. Couplings
15. Pumps
16. Lubrication
17. Care of Tools
18. Paperwork

Millwright learners supplement their practical shop experience with 96 hours of classroom work spread over two years

A · STUDY · IN · PIPE · COILS · AND · CONNECTIONS ·


ISOMETRIC DETAILS
2" SUPPLY
2"x1¼ RED CUP
6 BRANCH HEADER
SYLPHON TRAP
SEDIMENT POCKET
½ RETURN
6 BRANCH COIL
8 BRANCH HEADER
8 BRANCH COIL
FLOOR
GLOBE VL. UNION
SUPPLY MAIN
EXPANSION END
8"-1½ E. BL. ELLS
RETURN
6 BRANCH 1½ PIPE COIL 28'-0" LG 200 LIN. FT. = 60#
8 BRANCH 1½ PIPE COIL 35'-0 LG. 284 LIN FT = 80#
PRESSURE REDUCING VALVE
SET 125# TO 10#
RETURN LINE ON WALL UNDER COIL
¾ TRAP DRIP AT END OF MAIN
SYLPHON TRAP
RETURN LINE ON WALL UNDER COIL
10# STEAM
BY-PASS
125# STEAM
EXPANSION END
SUPPLY MAINS ON CEILING
MAIN ENTRANCE
TRENCH UNDER DOOR
AIR LOOP OVER DOOR
CONCRETE FLOOR WOOD PLANK CEILING 12'-0" FLOOR HEIGHT
ALL PIPING TO PITCH TO DRAIN
TYPICAL MAIN HGR
NOTE: NO PIPE COVERING THIS SIDE OF WALL, ALL PIPING BEYOND THIS WALL TO BE COVERED WITH STD. THICK 85% MAG COVERING
85% MAG. COVERING
3" UP TO 2ND FLOOR
6 BRANCH COIL 1½ PIPE 49'-0" LONG = 224'-0" 98#
TYPICAL HGR FOR RETURN MAINS
SYLPHON TRAP
EXPANSION END
DROP
SYLPHON TRAP
7 PIPE TROMBONE COIL 11'-0" LG. 77 LIN FT = 26#
6 BRANCH 1½ PIPE COIL 37'-0 LG. 222 LIN. FT = 74#
STEAM SUPPLY TO BUILDING
1¼" TO RETURN SYSTEM
½" SUPPLY
SUPPLY END
6 PIPE COIL
FLOOR
6 PIPE TROMBONE COIL
SYLPHON TRAP
SEDIMENT POCKET
FLOOR
ISOMETRIC DETAILS
DOOR

· PLAN · FIRST · FLOOR ·

SCALE ¼"=1'-0"

NOTE:
BUILDING CONSTRUCTION AS SHOWN
CONCRETE WALLS — STEEL WINDOWS
BRICK DIVISION WALL — FIRE DOORS
STANDARD STEEL PIPE
STANDARD C.I. SCREWED FITTINGS

LEGEND
RED ═══ DENOTES STEAM SUPPLY
PURPLE ═══ DENOTES STEAM RETURN
YELLOW ═══ DENOTES BUILDING CONSTRUCTION

Calco

FOR TRAINING PURPOSES ONLY

11-18-41 C.L.D.

Results to Date

FORTY-SIX MEN started a year ago. Some of them, it should be remembered, had for some time been helpers under good mechanics, so naturally had made considerable progress before enrolling in the training program.

Of these starters, 7 pipefitters, 3 millwrights, and 2 electricians have been promoted from the helper-learner to the mechanic class. Only 5 of the 46 have had marks below the passing score of 80; they have been allowed to continue because all have marks above 75. In classroom work the general average was 91, and 9 of the 46 had turned in perfect papers.

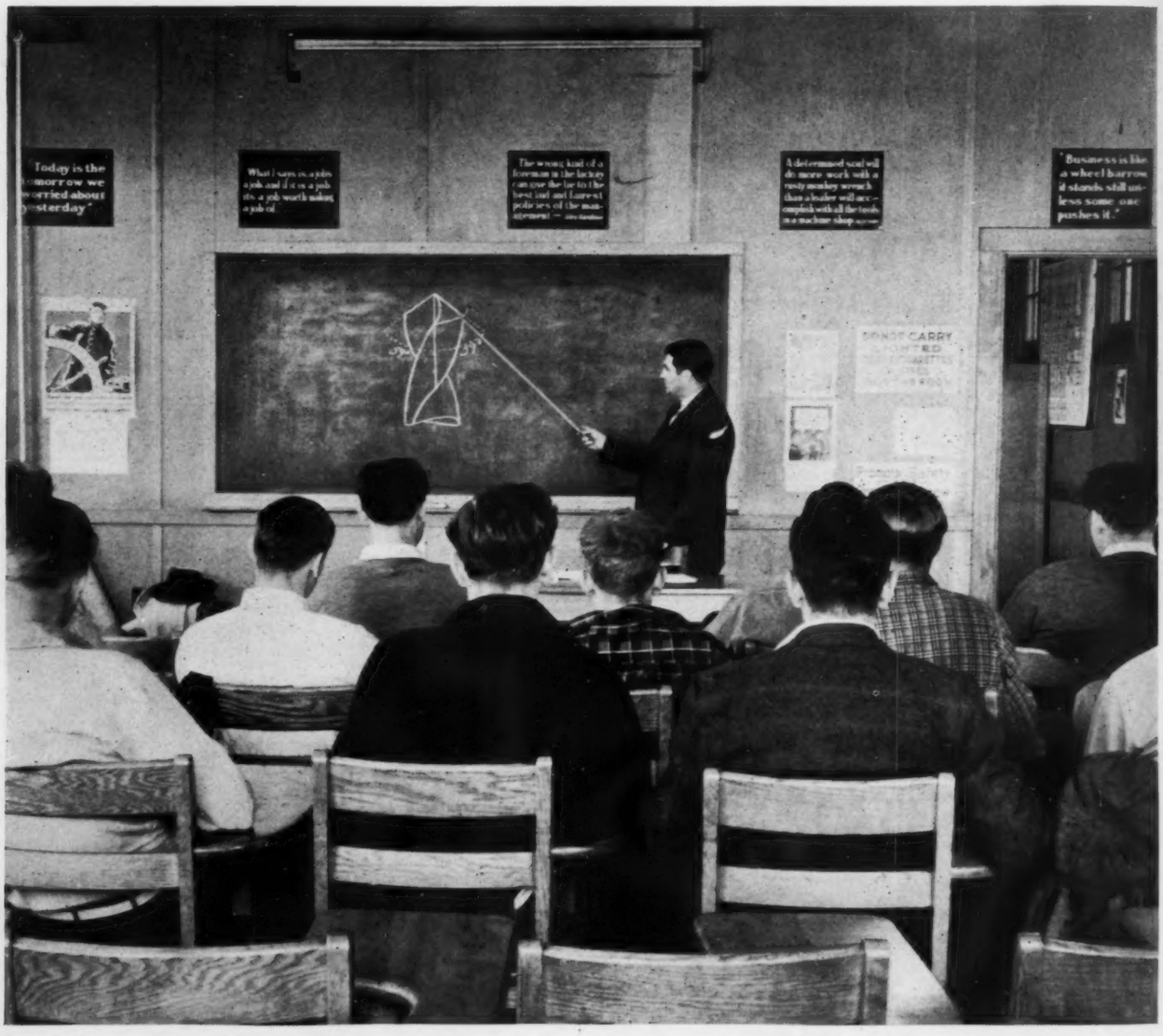
The program has met with such success that skilled mechanics in the lower grades have asked the training organization to put on a similar advanced program so that they, too, may develop their talents along the lines that will equip them for openings in the ranks of first-class mechanics. Last fall another group of learners were selected to begin where the first left off. Thus a continuous flow of trained mechanics will be developed.

From Four Years to Two

It is estimated that at the present time a new man coming into Calco will take from 24 to 36 months to obtain the technical knowledge and practical experience needed to become a first-class maintenance mechanic. Compare this with the old 48-month training plan and you will see that the program has been speeded up to the point where the required time has been cut a third to a half.

This first trial has proved so successful in the millwright, pipe, and electrical shops that it will be extended to tin, lead, and welding shops.

The advantage of this particular program is that it allows the man to progress as fast as he is able to absorb the practical and theoretical knowledge that is given him. His progress is not impeded by slower men. The program can also be adapted to cover all trades and crafts.



Class in millwright theory. Three of 20 millwright learners have already moved up to the mechanic class

Maintaining Buildings Under Corrosive Conditions

Each maintenance gang has its own foreman who is responsible for inspection and repair of everything that falls in his field. Schedules that still have enough leeway to take care of emergencies, keep work under control

LEE WELLS, Construction Foreman, Monsanto Chemical Company, Monsanto, Ill.

RULE ONE in building maintenance is that a stitch in time saves nine. Suppose corrosion sets in on a steel column—which can happen wherever there is exposure to corrosive fumes. Caught at an early stage, this corrosion can be chipped off, the surface cleaned or neutralized, and the column is as good as ever, once it has been repainted. But if the column is allowed to suffer corrosion until it is structurally impaired, the difficulty is likely to manifest itself as some other type of building trouble. Perhaps a leak starts in the roof because flashings have gaped or asphalt surfaces cracked open. Inspection discloses that the purlins have buckled here, and the cause is that a beam sagged out of level—above the corroded column.

Spilled and splashed chemicals act like dry rot on wood, only faster; carpenter foreman keeps constant check, has planks and boards replaced as soon as inspection shows a defective piece

Our entire program of building maintenance is based upon our creed that prevention costs less than cure. Some maintenance tasks need doing about every so often—painting building exteriors, or reputtying window sash. These jobs we put on a schedule for periodic attention, with the period sufficiently shorter than absolutely necessary so that we can postpone them a while if more urgent chores intervene. All other types of maintenance are handled by frequent and painstaking inspection.

Routine inspection of all our buildings goes on all the time. We have gangs of carpenters, painters, bricklayers, and ironworkers—each with its foreman. Each foreman has as a major responsibility the duty of inspecting everything around the plant that falls in his province. In terms of workaday practice, this means that whenever a gang has a job in one of the buildings, its foreman goes over everything about that building that concerns him. In between times, he has a look at some other building that he had not gone over recently.

It is expected that, barring emergencies, the foreman or subforeman of our carpenter gang will be on the prowl all the time, looking for carpenter jobs that need doing. He is directly responsible for roofs, walls, wooden sash, wooden platforms, and stairs. When he inspects a building, he clambers over it from the roof peak to the walkways in pipe tunnels.

Our maintenance problem is unquestionably more acute than in most industries, because of the presence of corrosive fumes and liquids. We often envy the maintenance men in such non-corrosive lines of industry as metal working or woodworking. They do not have exposures that may make a platform collapse with no more warning than if it were infested with termites, or that may cause roof boards to deteriorate so that replacement is necessary if the asphalt surface above is to be saved.

At the same time, we see nothing basically different in our maintenance problem from the maintenance problems of these other plants, except that ours is a speeded-up deterioration. What the other fellow should inspect once a year, we may need to inspect once a month. This merely means that we need more men to take care of the maintenance work. Much of our maintenance is, of course, on about the same periodicity as in other lines.

On wooden platforms, for instance, our carpenter foreman looks for deterioration of both planking and posts. What happens in most places where this is a problem for us, is a phenomenon much like dry rot, except that its cause is principally chemicals that spill out of tanks and get a purchase on the surface of the wood before they are washed away. The resultant rot is gradual, but far more rapid than natural dry rot. We watch this carefully, because of the danger of falls and consequent injuries. As soon as inspection shows a defective piece, it is replaced.

The same general type of difficulty

extends to roof boards, from exposure to fumes, but this can usually be detected from below by a difference in appearance of the wood. Here we always look also for leaks. It is perhaps an overstatement to say that we look for leaks. Of all types of building deterioration, leaks are the one variety that gets reported almost automatically. In a heavy rain, leak reports come to the maintenance department from foremen in production departments, and the carpenter gang repairs them just as soon as it can get around.

Another type of roof that we use is of book tile, with a mopped asphalt exterior surface. Despite its relatively impervious character, under our corrosion exposure, tile is subject to a definite deterioration. Tiles begin chipping or flaking off, and the only safe course is to replace the defective ones as soon as possible.

Most of our walls are of hollow tile, which are subject to attack from the same sources. The carpenter foreman, in his inspection of plant buildings, keeps his eyes open for signs of wall tile trouble, which may manifest itself as breaks, chipping, getting soft, or leaks. Replacing a defective wall tile is not much of a job, but if defects are not taken care of an entire panel may fall out of the framing.

Some departments are particularly tough on tile, others are hard on steel, still others cause us the worst of our wood troubles. Naturally, we bear down on these points in our inspection, and try to catch the difficulties before they become serious.

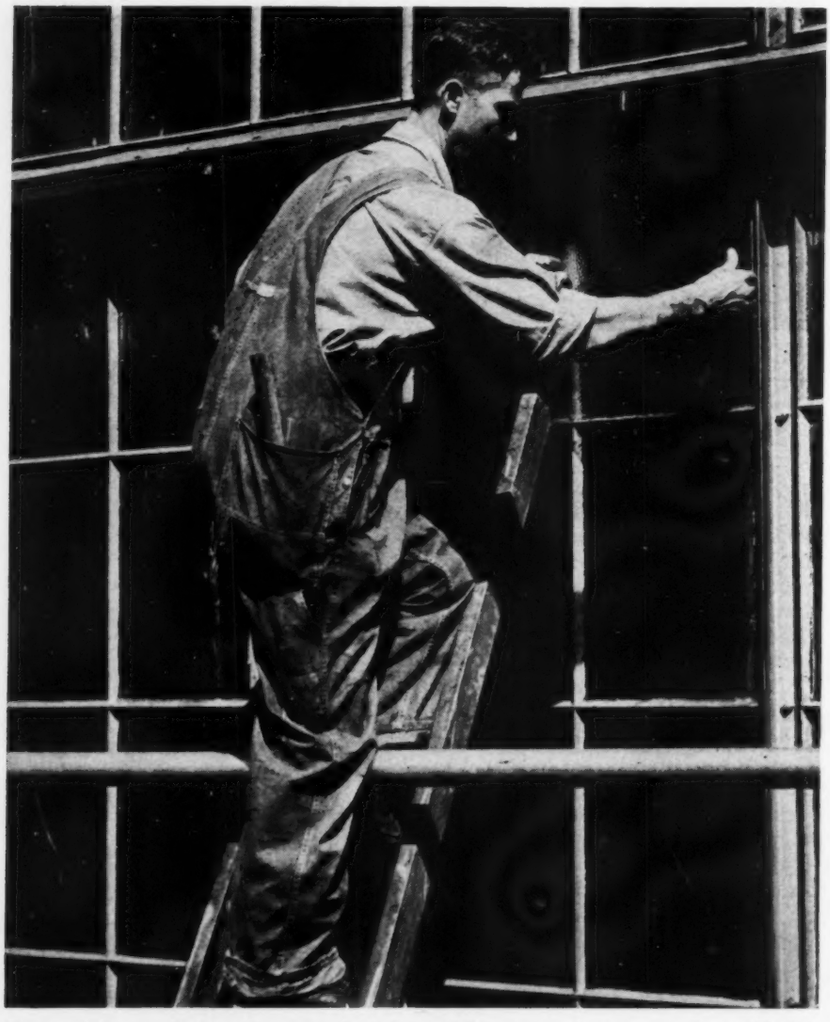
The ironworker foreman inspects steel throughout the plant, just as the carpenter foreman inspects wood and masonry. He particularly checks open-grating steel platforms, structural steel, and steel sash.

We used to have trouble with steel sash buckling at the bottom from corrosion getting in at this point. Now we hang these sash entirely from the top, and leave the bottom in the soft plaster where it can crawl if it wants to. On sash inspection, we look for corrosion and for the need of paint. Theoretically, if sash is corroded it can be scraped, wire-brushed, and repainted. Our experience indicates that if it is badly corroded, it is cheaper to replace the sash and avoid the usually fruitless effort to save it. Once a sash starts to buckle, there seems to be no earthly way to hold glass in it.

On paint and glass, the painting foreman is responsible for inspection. Two men work under him the year around. It takes them approximately a month to go over the 46,000-odd panes in the entire plant. When they have made the circuit, they do it all over again. We have a list of the number of panes in each building, and the types of glass—wire glass, double-thick window glass, sun-refractory glass. These buildings are scheduled in a regular routine, and the glass gang takes them in this order. Their primary duty is replacing broken glass, their secondary duty is repairing crumbling putty. We use ordinary putty, but are experimenting with the newer types, hoping that we can find one that will stand up better.

For painting we use a fixed schedule, listing all buildings. We attempt to rotate them, painting them in order. However, it usually happens that some buildings begin to show a need for paint before their allotted time. If a building goes bad before it is due to be painted, we move it to the head of the list and paint it, pushing the others back. Our effort is to repaint completely every two or three years, and we stay rather well within this schedule by keeping our gang of painters on the job all year. They work outdoors in any weather that permits, and the rest of the time take care of the indoor jobs.

All told, we have 11 carpenters, 11 painters, 2 bricklayers with 2 helpers, and 11 ironworkers with 11 helpers. These men spend their time principally on maintenance work, with some new construction and a variety of miscellaneous tasks that arise in a big plant. And because the work is carefully scheduled and controlled, we are convinced that our method of preventive maintenance definitely pays.

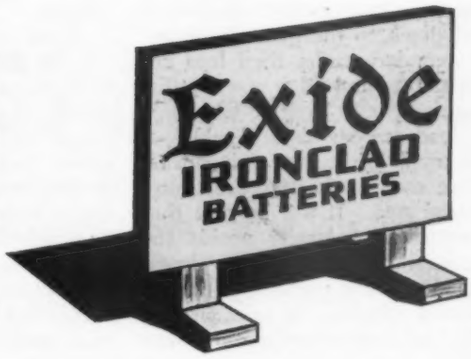


Part of the painting foreman's job at Monsanto is to see that all the 46,000-odd panes of glass are whole, replace them if cracked or broken. Putty around the windows must be watched, too

... and Exide steps up the pace

No *safe* degree of speed can be too great when an entire nation arms for total war. Every factory, mill, mine, and plant must push its production at maximum pace.

Exide-Ironclad Batteries ... with their surging power delivered at high voltage for good speeds ... help increase production in thousands of defense operations. Exide Batteries motivate tough little electric industrial trucks to move materials from place to place. Exide's dependability, economy, and relative freedom from breakdown, help prevent costly delays ... and help to *Keep America Rolling.*



THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

High-Voltage Distribution Saves Copper

Much smaller cables can be used when power is delivered at high voltage to load centers close to points of use. That's important, as war demands for copper grow

LARGE SAVINGS in important materials, particularly copper, and lower installation costs are among the advantages inherent in the load-center principle of power distribution. These principles of distribution are not new inasmuch as they have been used for years by utility companies. An intensive study by General Electric engineers of conventional distribution systems in industrial plants, however, has resulted in the development of inclosed substation equipment, Figure 1, specially designed for installation in production areas, to facilitate application of this type of power distribution in industry.

With the load-center power distribution system high-voltage power is distributed directly to the production areas or load centers, where it is stepped down to the desired voltage. Short secondary cables then feed energy to motors, and other power-utilizing equipment. Where the total power load exceeds about 1,000 kva. several small load-center unit substations are used, each near the center of its load area. It will be seen that this arrangement largely avoids the high cost and voltage drop incidental to the long, heavy low-voltage circuits that would otherwise be necessary.

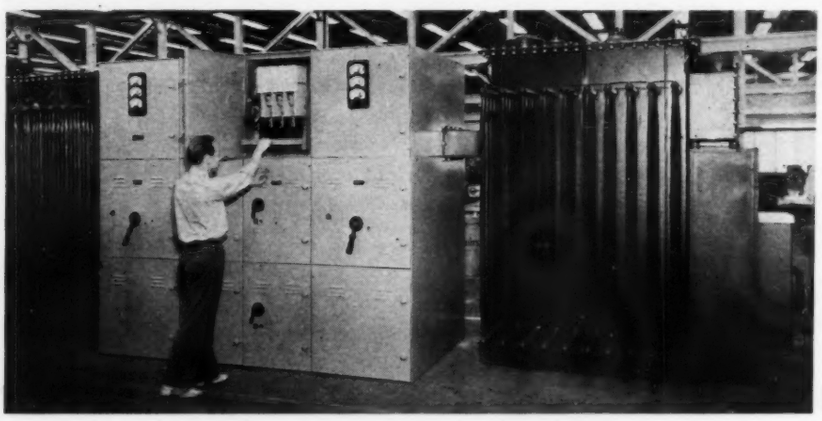


Figure 1. This 1,200-kva. load-center unit substation is installed in a large plant. Secondary air circuit breakers are of the draw-out type

Industrial distribution systems now in common use usually involve a large substation to transform sizable blocks of power from say 2,300 to 15,000 volts, down to the voltage at which it will be used. Heavy, low-voltage cables often of considerable length then distribute the power throughout the industrial plant to the various points of use.

In contrast, assume a plant with a demand of 3,000 kva. supplied from two utility 13,200-volt lines wherein power is distributed at 480 volts. It is estimated that use of a load-center distribution system in place of a conventional system will save 78,000 pounds of steel, 11,500 pounds of copper, and 1,300 pounds of other materials. In costs, the estimated saving will be approximately $12,000 or 21 percent.

These savings arise from several sources. Because the low-voltage feeder runs are short, less secondary cable is needed, resulting in a large saving in copper and steel. The transmission of power from a large substation to the production areas at low voltage requires many times the copper needed to supply the same amount of power at high voltage to the load-center unit substations. Since the smaller transformers of the load-center unit substation need less secondary short-circuit current protection, smaller feeder breakers can be used. Instead of an outdoor switching station, a small, compact, metal-clad structure is used, either indoors or out.

Little time is required to install the unit substations, since they are delivered assembled and wired and are ready for operation after a few sections have been bolted together and the cable connected. No vault or base is required for them.

Because of the shorter secondary runs, voltage variations and flicker are less than with conventional distribution systems. For example, it is estimated that the voltage drop from the beginning of the primary line to the end of the longest secondary in the plant mentioned previously would be only about one-half as much with the load-center system as with the older systems. Improved performance of motors and lamps is among the most important results.

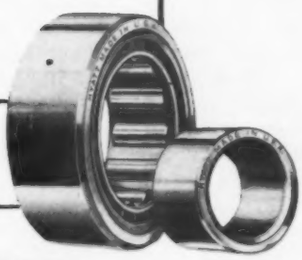
Other Advantages

There is the further advantage that the substation units can be placed on the production floor or wherever needed, while additional units can be installed when and where required without disturbing the system in the slightest degree.

An important advantage of a load-center system is that it can be laid out to employ any one or a combination of four basic circuit arrangements: the radial, primary selective, secondary selective, and secondary network systems. Each circuit arrangement has certain advantages. Therefore selection of the one best suited depends on the requirements of the individual plant from the standpoints of first cost, safety to personnel and equipment, operating simplicity, maintenance, voltage regulation, power losses, and flexibility of the system under consideration.

Where occasional service interruptions will not be serious, the simple radial system, Figure 2, is satisfactory. This system is the simplest and cheapest of the four circuit arrangements,

FIELD PIECE



OR

FIELD PLOW

HYATT QUIET ROLLER BEARINGS *serve both!*

Hyatt bearings serve the machinery of war—and of normal production, too. Their excellent quality and matchless precision make them quickly adaptable to all design conditions and situations. This comes naturally from Hyatt's 50 years of anti-friction bearing experience. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J., Chicago, Pittsburgh, Detroit, San Francisco.

since power is supplied to each low-tension load area over a single direct electrical channel.

Voltage regulation is slightly inferior to that afforded by the more expensive arrangements. Reliability is not so high as with other arrangements because failure of the primary cable or other equipment will interrupt the flow of power to the entire block. Inspection and maintenance are also likely to require interruption of power flow.

With the primary selective system, Figure 3, two sources of power supply are used, thus providing an alternate source if one primary feeder fails. The length of an outage is then limited to the time required to change over to the alternate source at the respective load-center unit substations.

Maintenance and inspection of primary circuit equipment requires only a short interruption, since the load centers can be individually transferred before deenergizing the primary feeder.

Operation of this system under emergency conditions is somewhat complicated by the need for primary circuit switching, whereas normal service switching operations are performed with low-tension circuit breakers.

Another disadvantage, which may be eliminated at added cost, is the close physical association of both primary feeder circuits at each load-center primary switching unit. Trouble here, such as electrical failure, fire, or bomb explosion, might involve both circuits and result in a complete loss of service.

The secondary selective system, Figure 4, differs from the first two in that the load center has complementary branches, each permanently associated with a particular high-tension feeder. Transfer from normal to emergency operation is accomplished by means of a low-tension tie breaker between the two complementary sections. Duplication of supply is thus extended to the load-center low-tension bus, providing for continued service with either a transformer or a primary feeder out of service.

Reliability Is High

Normally the system is operated with the tie breaker open and the transformer breakers closed.

Service reliability of this system is very high. Electrical faults affecting service on one primary feeder cannot interfere with service on the other feeder.

The secondary network system, Figure 5, differs from the others in that load-center units are permanently interconnected through low-tension tie circuits. Emergency power for a particular load center is obtained from adjacent load centers associated with different primary feeders.

First cost is considerably higher than that of the other arrangements, because of the added low-tension switching equipment and tie circuits required by this system.

Service reliability is extremely high since a primary feeder or transformer unit may be deenergized without interrupting service to any load center. Faults in primary feeders or transformers are automatically removed without service interruption.

Requires Skill

On the other hand, the necessity of opening several power source circuits to deenergize a particular low-tension bus somewhat impairs the degree of safety. Operation is more complicated. The maintenance and adjustment of network protectors and relays require considerably more skill than is needed for conventional air circuit breakers.

The unit substations used with the load-center distribution system are compact assemblies consisting of a high-voltage switchgear section, step-down transformer section, and low-voltage switchgear section. They are available for installation either indoors or outdoors in a wide variety of ratings.

Approximately 75 percent of the material saved by the load-center system is due to the reduction in cable required. Estimates cited previously in the savings in material were based on the use of varished-cambric interlocked-armor cable instead of wiring in conduit. It is estimated that the copper, steel, rubber, and other materials in wire and conduit needed for a load-center system in a building 400x750 feet with a 3,000-kva. load would weigh 25,000 pounds. Interlocked-armor cable for the same installation would require about 7,000 pounds of materials, including a negligible amount of rubber.

Copper conductors in interlocked-armor cable are each insulated with varnished cambric, stranded together with treated jute fillers. Rubber-filled tape and a single braid of cotton saturated with a flame- and moisture-resisting finish cover the conductor assembly. A flexible, interlocked armor of galvanized steel protects the conductors and insulation against mechanical damage.

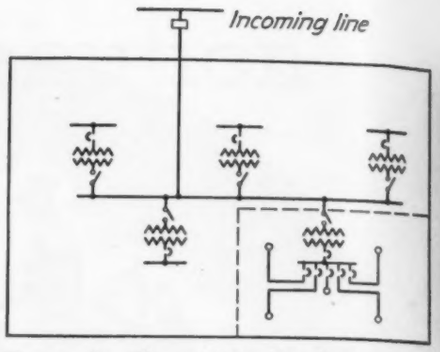


Figure 2. The radial distribution system is the simplest and cheapest of the four that are possible

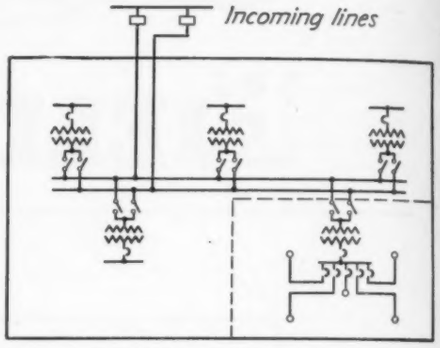


Figure 3. With the primary selective system two sources of supply minimize chances of interruption

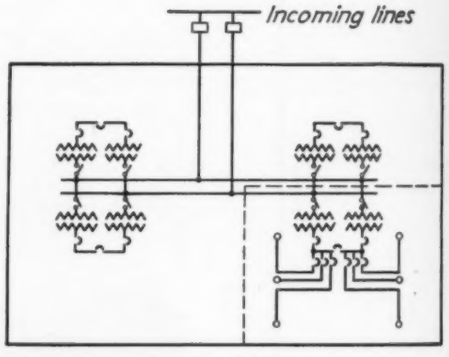


Figure 4. In a secondary selective system duplication of supply is extended to the low-tension bus

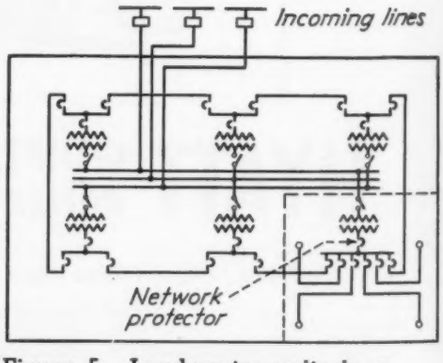
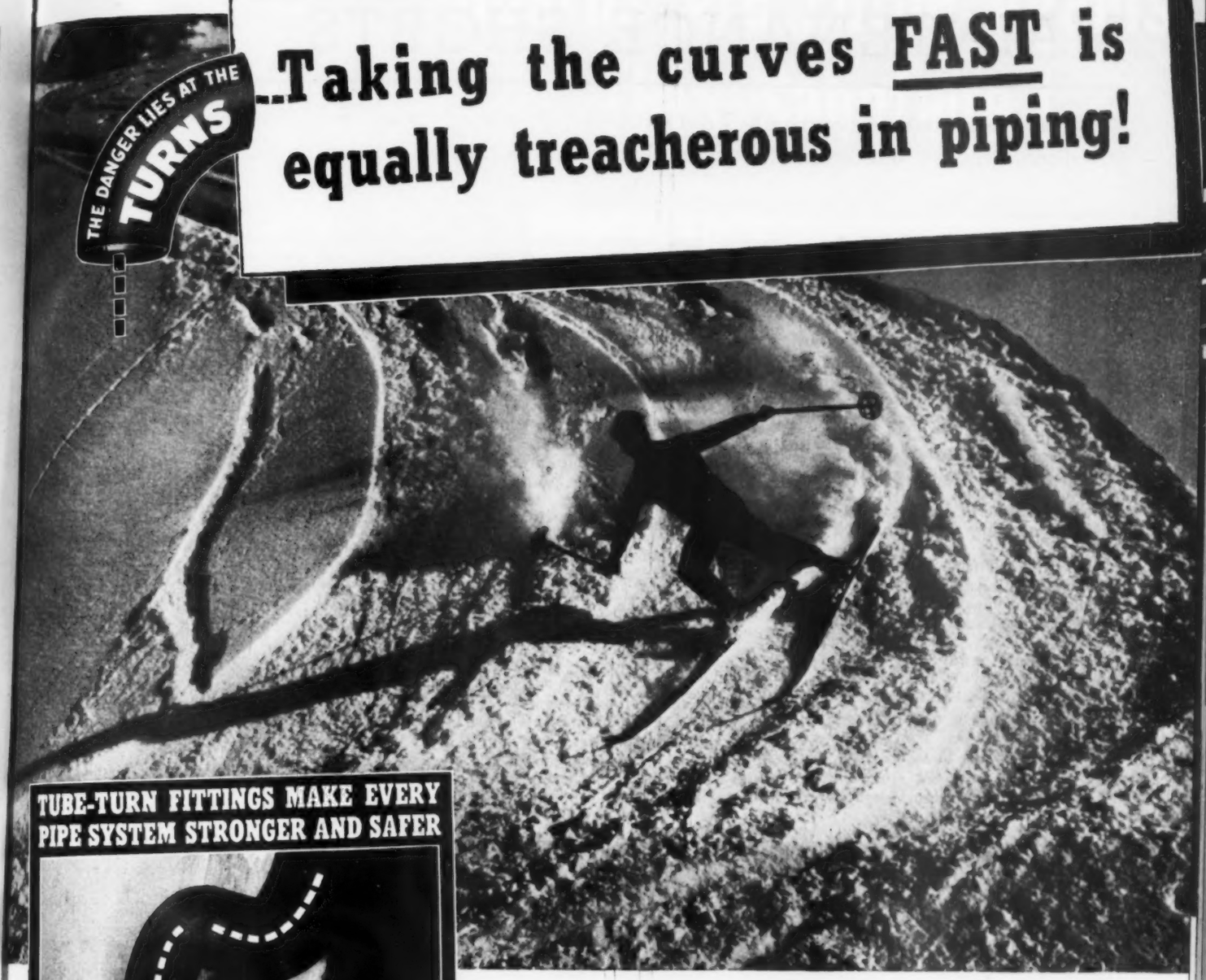


Figure 5. Load-center units in a secondary network system are connected by low-tension ties

Taking the curves FAST is equally treacherous in piping!

THE DANGER LIES AT THE TURNS



TUBE-TURN FITTINGS MAKE EVERY PIPE SYSTEM STRONGER AND SAFER

When pipe lines snake their way thru a plant like these chemical lines, forming neat, compact layouts, it's little wonder engineers insist on TUBE-TURN fittings. There are no flanges to tighten, no gaskets to replace—no chance of dangerous leakage. The turns indicated above —*where the danger lies*—are strong and safe—fully protected with TUBE-TURN welding fittings.

There's less flow resistance and pressure los when you use Tube-Turn welding fitting

A flashing glide down the mountain side into a splendidly execute *Kristiana*—a sweeping turn at full speed that scarcely slows the skier! It the same kind of uninterrupted flow that engineers desire in piping—an TUBE-TURN welding elbows and returns assure minimum resistanc thanks to the easy sweeping radius throughout. TUBE-TURN fitting smooth inner walls are free from waves, scales or ridges which often acce erate corrosion and erosion. TUBE-TURN fittings give *plus strength* whe the danger lies—at the turns—wherever there is a change *in flow direction* For safe, trouble-free piping systems, insist on TUBE-TURN welding fittings

Write today for TUBE-TURN engineering data book and catalog.

TUBE-TURNS, Inc., Louisville, Ky. *Branch offices:* NEW YORK, PHILADELPHIA, CHICAGO, PITTSBURGH, CLEVELAND, TULSA, LOS ANGELES. *Distributors everywhere.*

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The ★ FIRST WELDING FITTINGS 1ST AND STILL THE BEST

Welding Fittings

MAINTENANCE SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for

Midget Switches Make Press Operation Safe

EDWIN H. SCHAEFFER, Industrial Engineer, J. E. Ogden Company, Bayonne, New Jersey

One of our worst accident records during the last quarter was on a battery of four, light, horizontal air presses used for small parts assembly.

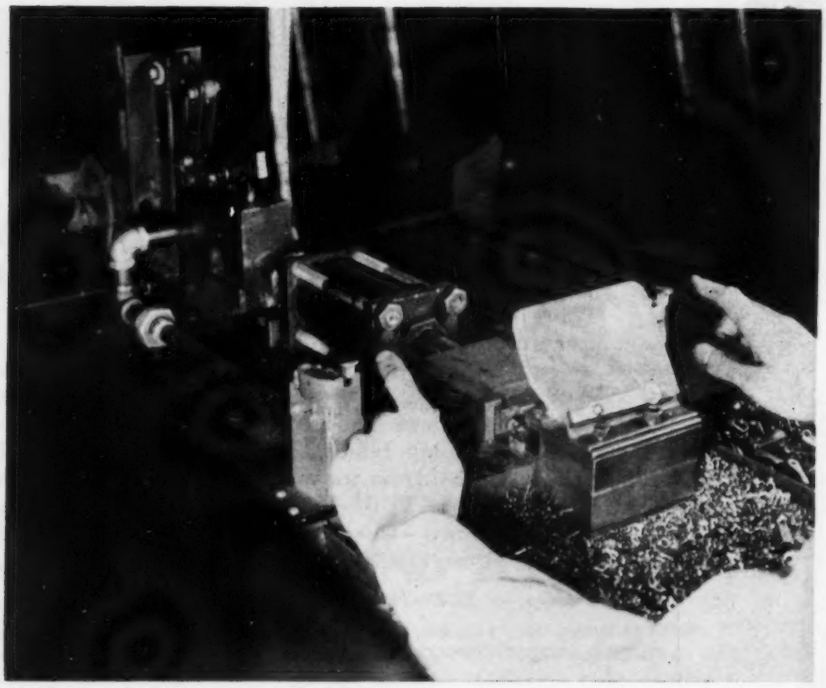
As designed the press required foot operation of the air valve. Not only was this requirement fatiguing, but it also turned out to be extremely dangerous, because it was possible for the operator to have her finger in the die and step on the air valve pedal at the same time. Three operators injured the end of an index finger by missing the timing of the foot operation when placing parts in the die to be assembled.

Conventional guards were considered. Among them was the two-hand manual control, which requires the operator to have each hand on an operating lever before the valve will trip. This arrangement was too clumsy and heavy, however, for hand operation on a fast cycle for any length of time. Complete re-design of the assembly press seemed necessary. Fortunately, further study of the condition produced a satisfactory and economical solution.

A solenoid was attached to the air valve and connected to an electrical control circuit that requires the simultaneous closing of two ¼-oz. switches for operation. These tiny switches, placed conveniently in the operator's normal work area, now control the air press. After the operator has positioned the pieces in the die, her hands move away in a "transport empty." The switches are placed in the path of this transport, at a safe distance. Each hand touches one (only a slight pressure is required), and as the solenoid closes the air valve opens and the press goes into operation.

With this control the operator's hands must be on the switches, hence the fingers cannot be in or near the die. At the same time, the tripping action is almost effortless, and requires but a negligible amount of time.

There have been no accidents on the presses since these controls were installed. We are considering placing a similar control on several of our heavy punchpresses, which are at present equipped with manual, double-level, clutch control. The solenoid would then be attached directly to the clutch rod. The main advantages gained would be the effortless operation of the switches, the possibility of locating them more conveniently than it is possible to locate the clutch levers, plus a consequent probability of greater output without sacrifice of safety.



To operate this air press, the operator must have both hands on the two ¼-oz. switches which must be tripped simultaneously before the press will go into action. Keeps hands from the danger zone

•

To call attention to fire's serious threat to production, the Associated Factory Mutual Fire Insurance Companies distributed posters like the above to their insured industrial plants. Fires caused by carelessness, inadequate employee training, or lack of necessary safeguards, can be just as detrimental to our war effort as those due to sabotage

•

Jets Prevent Flare-Outs From Pressure Furnaces

S. H. COLEMAN, Roanoke, Va.

Operation of process and other furnaces at pressures slightly in excess of atmospheric pressure is frequently advantageous in certain industrial operations.

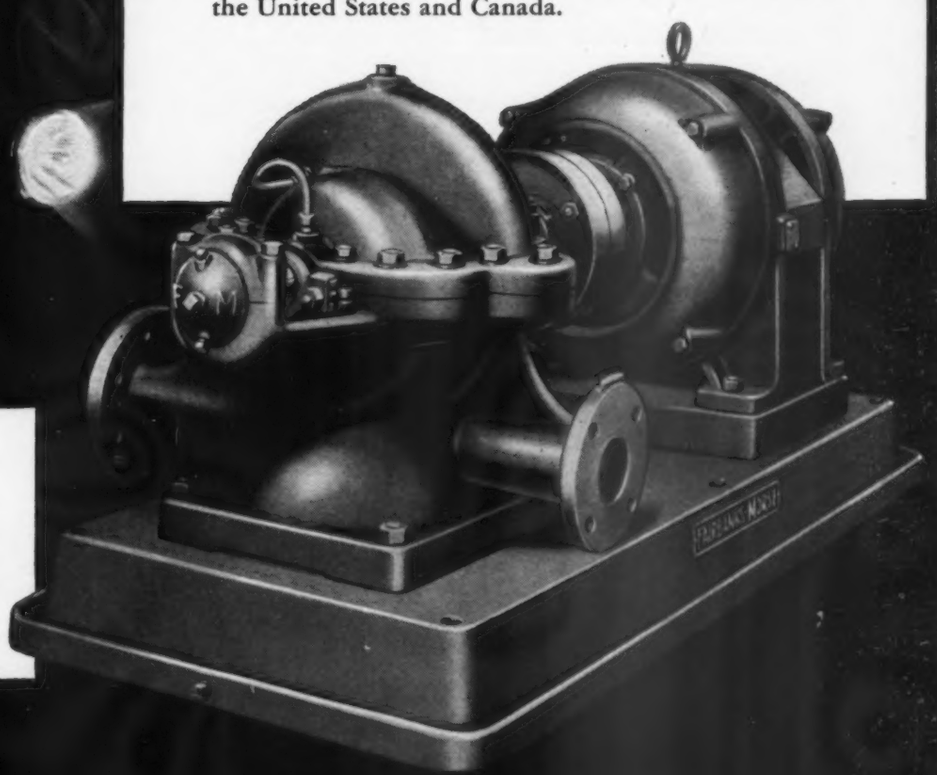
Although pressure combustion may be well suited to some particular process, it has several drawbacks, one of which is the difficulty of preventing flareouts of flame and heated gases from necessary openings in the furnace. Outflow of these heated products of combustion is not only wasteful and inimical to good housekeeping, but

Guards Are Futile Against THIS Sabotage !

RIGHT under your guards' noses, unsuspected saboteurs may be steadily draining off vitally needed power... handicapping production as much as would destroying one generator out of every four or five!

These unsuspected saboteurs *are* at work in your plant if your pumps are not of the latest, improved designs. For ten-year-old pumps of certain types, even if as good as new, require 25% more power than today's Fairbanks-Morse models. And 4- or 5-year-old pumps of other types consume so much more power than current models that continued use is more costly than replacement.

Find out *now* if *your* pumps are the types which curtail production and steal power and profits. Let a Fairbanks-Morse Pump Engineer make an inspection, with no cost or obligation to you. Write Fairbanks, Morse & Co., Dept. C31, 600 S. Michigan Ave., Chicago. Branches and service stations throughout the United States and Canada.



FAIRBANKS-MORSE CENTRIFUGAL PUMPS

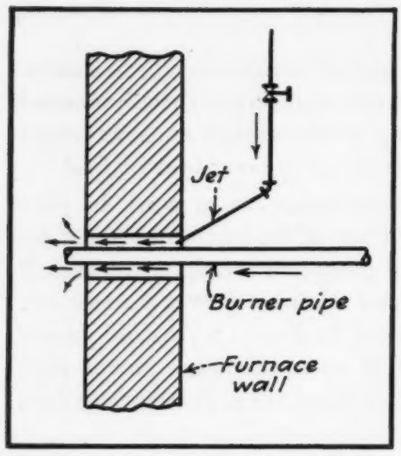
A complete "family" of single-stage, split-case pumps for low, moderate, medium, and high heads, is described in Bulletin 5810D. Many other bulletins available on other types.

FAIRBANKS·MORSE PUMPS

DIESEL ENGINES ELECTRICAL MACHINERY MAGNETOS RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS
PUMPS MOTORS FAIRBANKS SCALES WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

is also extremely hazardous from a safety standpoint.

A method of overcoming this difficulty, so far as observation ports, fuel nozzle injection openings, and other necessary apertures are concerned, is to direct into the open space jets of steam or air having



a sufficiently high velocity to overcome the pressure differential existing between the inside and outside of the combustion space.

Such a jet, shown in the drawing, can be easily made by flattening the end of a small-diameter pipe nipple.

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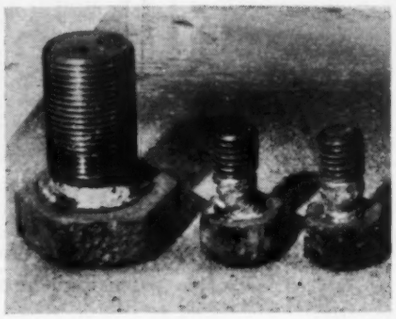
Removes Broken Stud Bolts by Welding

SOURCE—The Lincoln Electric Company, Cleveland

Removing broken stud bolts is a time-consuming operation that frequently requires the services of a machinist, but two



New Yorkers, Alex F. Morton and William F. Kramer, have developed a method using the electric arc process of welding by which broken bolts can be removed in about 1/20 the usual time.

Ordinarily machinists drill the stud with a small drill, and then use a larger drill to remove as much of the stud bolt as possible without touching the threads. They then break out the remaining thin shell with a small tool. After this the hole usually needs re-tapping, adding a fourth operation.

By Morton and Kramer's method a nut is laid above the broken stud. (The inside diameter of the nut should be slightly larger than the outside diameter of the stud bolt.) Then the stud is built up with weld metal and welded to the nut.

Thus equipped with a new head the bolt may be removed with an ordinary wrench. In some cases a frozen stud bolt will require heating of the area surrounding the bolt to expand it and permit the bolt to be removed. Often the welding operation itself will heat the area sufficiently to permit the removal of the stud as easily as an ordinary nut.

Illustrated are bolts removed by this method. When the hardened studs are broken off level, a machinist will take about an hour to remove the bolt by drilling, according to observations made by Kramer and Morton. If the stud is broken off at an angle, the machinist must take much longer, because the drills will break, or "run", on the slanted part of the stud.

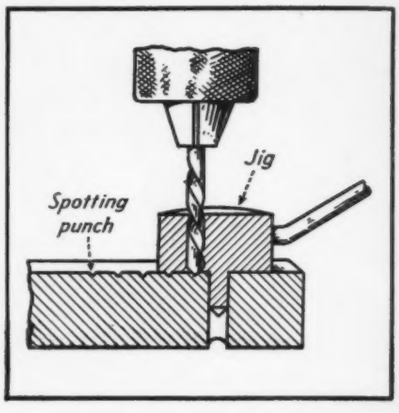
The method described is said to permit removal of an average of 20 broken studs per hour, regardless of the angle of break. It also permits the return of broken parts to service much sooner than heretofore.

•

Pilot Jig for Drilling Closely Spaced Holes

C. H. WILLEY, Penacook, N. H.

When one needs to drill a series of closely spaced holes, or holes with circumferences tangent to each other, the job can be simplified by use of a pilot type of drill



jig. The pilot should be of the diameter of the drill to be used, and formed by turning and hardening a piece of tool steel.

As the sketch shows, after the first hole has been drilled the pilot jig is put into it and the next hole is drilled through the hole in the jig. A spotting prick punch is used to start the drill point where the holes are desired.

Photograph by courtesy of Westinghouse Electric & Manufacturing Co.

Floodlights mounted in groups on poles 50 feet high cast a protective light on yards fronting on warehouses and foundries of the Federated Metals Division, American Smelting & Refining Company, San Francisco. They may be operated singly, in groups, or by remote control from master switches located at watchmen's stations

Hygrade Sylvania photograph

Lighting Takes on New Significance

Lighting, because of the war, has taken on new significance in America's industrial plants.

In the blackout plants, no activity whatever can go on unless man-made light is available.

Even in the large, single-story plants with vast expanse of glass in walls and roof, continuous operation shifts the bulk of the lighting burden from natural to artificial light.

No multistory plant, unless it is very narrow, can often depend entirely upon natural light, even for the daylight shift.

Good lighting will do much to offset these obstacles that stand in the way of achieving the output that is industry's and the nation's goal. In many ways good lighting will contribute to the battle of men and machines against time. Here are some of them:

Good lighting will increase the *quantity* of production of war matériel and essential civilian products. Man cannot work in the dark, and the farther his lighting conditions are removed from darkness in their approach to optimum lighting, the more he will produce.

Good lighting will increase the *quality* of production. Machine setting, instrument reading, inspection typify jobs that will be done better.

Good lighting will increase the effective hours spent on the job. Elimination of eye strain and

eye fatigue will reduce both absenteeism and low-production work. And more hours will be worked because of fewer lost-time accidents.

Good lighting will increase morale. Good lighting and good cheer go together. Satisfied workers spend more time on the job and turn out more production than do dissatisfied ones.

Good lighting will increase the effectiveness of supervision. Industry's foremen, of which there are all too few, will be able to see more of their operators and machines at one time, and will be able to supervise more workers.

Now that industry must carry the staggering burden of an unprecedented production, it is well that the scientists and manufacturers who have concerned themselves with artificial light have made so much progress.

Thanks to them, much is known about the amounts and kinds of light that are right for both the human eye and the job. Thanks to them, there are available those seeing-tools that can render invaluable aid to industry in the prosecution of its part in the war—"too much production too soon."

Miller photograph

Lighting in an aluminum foundry is supplied by 40-watt fluorescent tubes mounted 10 feet high, on 8-ft. centers. Intensity, 24 foot-candles

Incandescent and mercury vapor units mounted side by side give workers in this shop 24 foot-candles of light

GOOD LIGHTING WILL HELP US WIN

Light for Production

IN THE COREROOM of a large malleable iron foundry two shifts working a total of 256 manhours a day are now turning out a larger number of cores than were formerly produced by three shifts working 312 manhours. The increase in core production amounts to approximately 25 percent.

Output went up 8 percent almost over night in the finishing department of a plant manufacturing metal parts, while the amount of defective work was simultaneously cut 4 percent.

Production executives of a plant that manufactures rubber products were concerned over the fact that rejects of work turned out by the night shift were considerably greater than on the day shift. They sought the cause; when they found it, production on the night shift rose at once to the daytime figures, while over-all spoilage dropped almost 30 percent.

How were these increases in production, decreases in spoilage, brought about? Simply by providing good lighting, in place of the indifferent or poor lighting previously furnished. These three examples of the concrete, measurable benefits of good lighting are broadly typical of the results achieved in a great many other plants that have brought their lighting systems up to modern standards.

No one would think seriously of asserting that the eye doesn't need light in order to function. Everyone knows that his eyes are practically useless in real darkness. Even walking around may be dangerous, because of the likelihood of tripping or falling. Certainly it is impossible to carry on any useful activity without light.

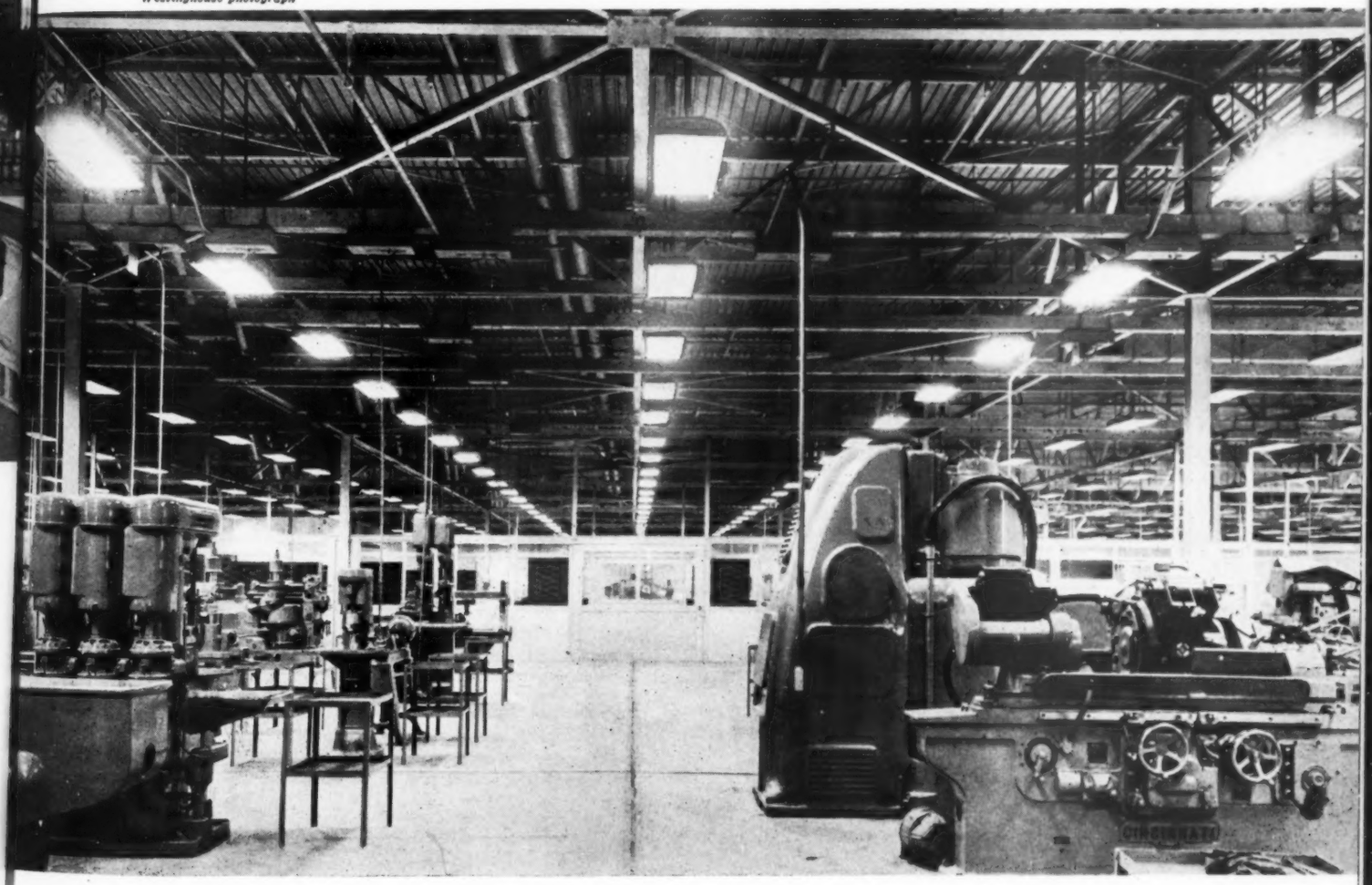
There is no argument, then, as to whether factory and other workers need light, but opinions about how much light is needed may vary widely among those who are not familiar with all the factors involved.

Under ordinary circumstances one can see well enough to distinguish nearby objects and walk around with reasonable safety when the amount of light is only a fraction of a foot-candle, as under starlight or dim moonlight. It would be difficult or impossible, however, to do any work that involves the ability to see clearly. Obviously, more light must be provided if the eyes have to be depended upon to direct the hands.

As the duty imposed on the eyes increases in severity, they require more and more light, but the intensity suitable for a given task depends on several factors. For example, size and color of the object handled are of prime importance. Color of the background also makes a great difference.

In windowless plant, units containing three 40-watt fluorescent lamps, supply 25 foot-candles

Westinghouse photograph



Age of the worker enters into the problem because as the eyes grow older they require more light in order to function effectively without strain.

Fineness of the details that must be observed has to be considered.

Condition of the worker's eyes is also an important factor because some persons have been handicapped by nature with eyesight that is not up to normal standard.

Then, too, the matter of the ease and speed of vision must be looked into.

Importance of some of these factors has not always been recognized. In fact, the actual existence of some has become widely known in recent years only through intensive research and study. Certain it is that many older industrial lighting systems were laid out with scant regard of principles that are now considered of fundamental importance. Those who have to work under inferior lighting conditions may do so without complaint, but they cannot escape paying a penalty in unnecessary nerve strain, headaches, lowered personal efficiency, perhaps indifferent morale. And these conditions are, of course, inescapably reflected in less than maximum output per worker, lower quality of work, more rejects, increased number of accidents.

Proof that quality and quantity of output are affected in these ways is found in the examples cited at the beginning of this article. It can also be found in almost every plant that replaces an outmoded lighting system with one that conforms to present standards.

With industry engaged in the biggest job it has ever been called upon to do, anything less than the maximum output of men and machines will not be enough. Good lighting can do a great deal to make the maximum level of production possible.

An adequate and well-designed lighting system brings to every plant these advantages:

1. *Increased production.* When light is adequate, an operator or inspector does not have to look long and fixedly, straining his eyes meanwhile, in order to make out fine details or detect minute flaws. The more light, the greater the speed and accuracy of seeing. The necessity of spending a few extra seconds to be sure of some reading or detail may not seem to be important. But, if that process has to be repeated many times a day, the time thus lost runs up into minutes. When a large number of men are doing the same thing, this unnecessary waste of time that could be used productively reaches a total that is worth thinking about. Greater ease in seeing results in the expenditure of less nervous energy and therefore leaves more energy for productive work.

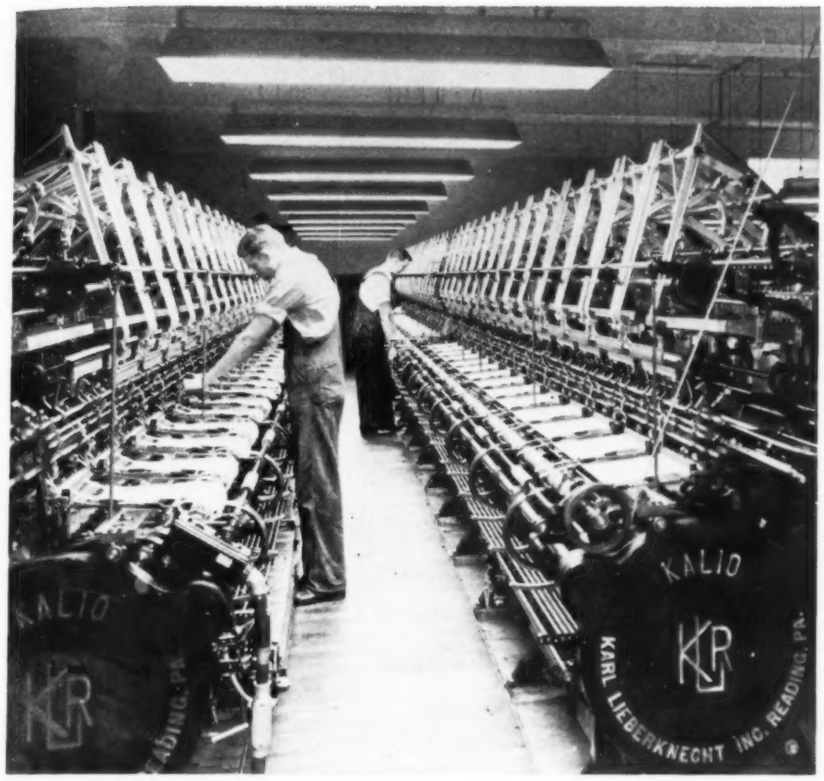
2. *Better workmanship.* Under good lighting workmen can see what they are doing. There is no necessity for making guesses or taking chances, and less excuse for making mistakes. Furthermore, since defects can be detected more readily, they are much more likely to be caught before the part has gone through all operations and up to final inspection. Hence there is less wastage of time and effort.

3. *Keeps older workers producing.* Advancing years tend to dim the eyesight of older employees whose skill and knowledge are needed now as never before. When these old-timers are provided with good lighting, tailored to individual needs, it is possible for them to keep on doing the precision work for which they are fitted, instead of being retired or assigned to other tasks where their training and experience are of little value.

Fluorescent luminaires containing two 40-watt lamps supply inspectors with 50 foot-candles

Wheeler Reflector photograph

GOOD LIGHTING WILL HELP US WIN



Benjamin Electric photograph

Three fluorescent lamps are mounted 7 feet high on 66.5-in. centers, give knitters about 45 foot-candles

4. *Less eyestrain.* Older workers are not the only ones who profit by good lighting. The eyes of young workers, too, become fatigued and strained when they are required to perform tasks for which the illumination is not adequate. Eye fatigue and strain are a frequent cause of headaches and general discomfort. One large plant has reported that, following the installation of a modern lighting system, the dispensary found there was a decrease of approximately 30 percent in calls for headache tablets. Furthermore, a large percentage of younger employees—nearly 40 percent, it is estimated—have eye defects of one kind or another. Good lighting will do much to overcome such handicaps.

5. *Reduction in accidents.* A striking example of the close relationship between lighting and accidents has come out of the Berger Manufacturing Division of Republic Steel Cor-

It's always bright under 40 foot-candles supplied by fluorescent fixtures on 10-ft. centers

Fostoria Pressed Steel photograph

General Electric photograph

Mercury-Mazda units, spaced 20x20 feet in high bays, 15x15 in low, furnish 40 foot-candles

poration, Canton, Ohio. In the punchpress department of this company the intensity of illumination was recently raised from 1.5 foot-candles at the working level to 19 foot-candles. Frequency of minor accidents dropped almost immediately from 4.1 to 1.9 per thousand manhours—a reduction of nearly 54 percent.

A similar story, differing only in details, comes from a large automobile plant. Here, again, the lighting system in the heavy punchpress department was replaced with a new system designed to provide good lighting. Accurate records of minor accidents during a period three months before and three months after the new system was installed, showed a drop of 11 percent in the number of such accidents.

The president of a metal stamping company has reported that, following the installation of a new lighting system, there was an immediate and appreciable decrease in the number of accident cases treated in the plant dispensary. The reason for this decrease is attributed to the fact that the men can now see clearly with much less effort than formerly; hence they avoid many accident hazards.

So many factors are involved in industrial accidents that it is practically impossible to say what percentage of such accidents is caused by poor lighting alone. It is only reasonable to assume, however, that with the quicker perception and greater clarity of vision that good lighting makes possible, accident hazards will be recognized faster and more definitely. This assumption is supported by the examples just cited.

6. *Better morale.* Maintenance of high morale among workers is always an important matter. When emergency conditions, as at present, require maximum effort and output from every worker, morale becomes vital. Whether the morale of a group of workers will be high or low will depend on circumstances that are not susceptible to exact measurement. Good lighting, nevertheless, is recognized as a highly potent factor in the maintenance of high morale. As a matter of practical psychology, it is much more difficult to nurse grouches and let little irritations grow into big ones in bright, cheerful surroundings than in a dark, gloomy place. Light naturally tends to beget cheerfulness. When cheerfulness abounds, morale is likely to be high.

7. *Better housekeeping.* Dirt and disorder in a plant are distinctly bad from several standpoints. They tend to be destructive of morale. This effect in turn may well be reflected in poor quality of work, high costs, and lack of pride in workmanship. Furthermore, accident and fire hazards are certain to be higher in a plant that is cluttered up and dirty than in the plant where the principles of cleanliness and good housekeeping are strictly observed.

When illumination is poor, it is difficult to see clearly under machines and benches, and in dark corners. Such places readily become dumping grounds for all manner of debris.

Good lighting shows up accumulations of rubbish and provides a powerful incentive for removing them or preventing their occurrence.

Light for Health

Newspictures photograph

VICTOR G. HEISER, M. D.

Health Consultant to the National Association of Manufacturers

EVERY PAUSE is a Nazi gain—*work on*. This slogan is one of those displayed in hundreds of British workshops, large and small, since the fateful Labor Day weekend of 1939.

Today that warning has assumed new and grave importance to the management of American factories that are given the responsibility of producing weapons for our armed forces. Ever since the Sunday attack on Pearl Harbor, every pause, for whatever reason, in our production of weapons means a loss that cannot be made up until the war is over. The responsibility for continued production cannot be averted, but we can control many of the factors that may delay or interrupt production.

One of the surest ways to guarantee maximum production is to provide proper lighting of our factories. The vast majority of American factories are well lighted, and there has been in this country a never-ending hunt for new and more scientific methods of providing still better lighting. But the importance of proper lighting in industry has never been greater than at this moment.

One reason for this fact is that hundreds of thousands of factory workers have been switched from jobs that they were thoroughly trained to handle, to new work that is more difficult, more tedious, more tiring. Other thousands of green workers are being employed in war plants. Employment of these hundreds of thousands of men and women in many war plants may, if we are not alert to the problem, result in many, many thousands of workers suffering from acute eyestrain after the period of the national emergency is over.

Combined Effort

Lighting engineers and the medical profession can combine their efforts to avoid this result. It is the job of lighting engineers to determine whether the workers in our plants have sufficient light. The plant physician or nurse should study the work schedules to determine whether switching workers periodically will not increase production and relieve eyestrain.

The British recognized during the early months of the war that proper lighting of defense plants was necessary. A survey was made of 1,500 industrial plants in England, the majority of which were making weapons. It showed that errors could be reduced exactly 50 percent by proper lighting. In addition, the use of proper lighting in these factories accomplished many other things necessary to beat the Nazis—spoilage of materials and products was lessened, waste due to mistakes fell off, damage to machines was minimized, and accidents that kept machines down for repairs were fewer. The test, furthermore, according to reports brought to this country, was of particular interest to military authorities. It was said that by proper lighting of these plants enemy action through sabotage and espionage was minimized.

The basic requirements for proper industrial lighting are:

1. The light should be adequate at the darkest point in the area that is being lighted.
2. Glare should be avoided.
3. Illumination should be fairly uniform throughout working space.
4. Light should be properly directed and suitably diffused.
5. Color of the light should be suitable for the purpose.
6. Light should be steady.

The outstanding authority in the field of industrial lighting is the Illuminating Engineering Society. In cooperation with the American Standards Association, the code for lighting of factories, mills, and other workplaces was prepared by the society in 1930 and revised in 1940. This code will be superseded by another bearing the title, "American Recommended Practice of Industrial Lighting," approval of which by the American Standards Association is expected shortly. In it are give the recommended levels of illumination for various operations in many industries.

There is one other matter in connection with the subject of proper lighting that must not be overlooked, because it spells the difference between a successful campaign and one halfway done. That is the necessity of having someone in the plant responsible for the upkeep of the lighting facilities. This man should make a daily check of the plant. He should replace burned-out lamps and broken fixtures, and should be responsible for seeing that lights and fixtures as well as walls and ceilings, which serve as reflecting surfaces for the lights, are kept clean.

The FBI has thought the subject of lighting so important that recently it checked 3,000 plants making war products to determine whether the lighting of the properties was reasonably in keeping with the needs.

Wakefield Brass photograph

Drafting boards get 80 foot-candles from luminaires containing two 40-watt fluorescent lamps

Paint and Light

LIGHT AND PAINT are partners in banishing darkness from factory production floors. The right combinations increase production, step up efficiency, create safer working conditions.

Lighting is handicapped by gloomy or dirty walls, ceilings, and floors. It is more costly, too, because the light is being absorbed or poorly reflected by the surroundings. Merely increasing the amount of light will not be a complete answer. To treat interior surfaces effectively, however, knowledge of the effect of light upon paint is essential.

We must remember that incandescent, fluorescent, and mercury-vapor lamps do not duplicate daylight exactly. All things look different under artificial light.

Incandescent lighting is still the most common artificial illumination. We are accustomed to the changes that take place under it. Blues fade or become darker; reds assume a yellowish or golden tinge; yellows change to stronger yellows.

With fluorescent and mercury-vapor lighting the situation is different. When this kind of illumination is compared with incandescent or natural daylight, the effects produced are sometimes difficult to comprehend.

In order to understand the transformations in appearance that take place under any artificial light, several factors must be taken into consideration. Among the more important are:

1. Pigmentation or color of paint or object.

2. Color of the artificial light by which it is seen.

3. Contrasting colors of surrounding areas or objects.

When light hits a surface, two things happen. Some light is absorbed and some is reflected. The character of the surface, color, and finish determine how much light is absorbed and how much is reflected.

Polished silver reflects 92 percent of the light hitting it; white blotting paper, 80 to 85 percent; white paint, 75 to 90 percent; black paint, 3 to 5 percent.

Colored or painted surfaces reflect light according to their color composition and the spectral characteristics of the light. Under fluorescent or mercury-vapor lamps a blue-black paint, for example, might have a definite blue hue, because it would reflect the strong blue and violet lines

of light from these lamps. Under incandescent illumination, however, the blue tinge might not be noticeable at all, because of the small amount of blue in the light. In other words, colors in a paint are accentuated by similar colors in light, and are dulled or changed by contrasting colors in light.

The type of surface—whether rough, mat, enameled, or highly polished—has little effect upon the amount of light reflected, but it does determine the type of reflection, of which there are several.

In regular reflection, light rays leave the surface at the same angle by which they reach it. This type of reflection is characteristic of highly polished surfaces and mirrors.

In perfectly diffused reflection, light is distributed in all directions, independent of the angle at which it strikes the surface. This kind of surface, referred to as mat, is produced by dull wall paints, and its brightness is constant from all viewing angles. Freshly fallen snow is one of the most nearly perfect examples of this type of reflection. Less perfect examples are unglazed plaster of Paris and blotting paper.

Some surfaces produce spread reflection. The effect is like regular reflection, except that part of the light is spread or scattered. Sand-blasted glass is an example.

Some types of reflection are combinations of those already named. An example is diffusing surfaces that are glazed with a superficial coat, and show both regular and diffuse reflection. An image of the light source can be seen, as in regular reflection, but the diffuse reflection makes the image less distinct. Varnished surfaces and porcelain enamel are examples of this type of reflection.

Mercury-vapor lamps have high efficiency and are particularly useful for industrial lighting. They are usually employed in high-bay installations, but are used only when colors of paints and other surfaces are not important considerations.

Colors Change

With a typical mercury-vapor industrial lighting installation, the following general effects were noted. Red became a deep maroon with almost a brown cast. Bright orange was a pale washed tan. Yellow was bright and vivid. Blue, green, and violet were all likewise intensified. White and black were unchanged. Silver paint took on a definite light-blue hue. A walnut-stained desk appeared a dirty yellow.

While the three tints of white fluorescent lamps have individual color characteristics, all are produced by an electric discharge through mercury vapor. Ultraviolet rays generated activate certain chemicals in the lamps, known as phosphors. Under this activation these phosphors glow with a continuous spectrum. The light emitted is strong, however, in yellow, green, and blue because of the mercury-vapor discharge.

The three tints of white fluorescent lamps have characteristics as follows:

1. *Daylight*. It is the closest match to natural daylight in the shade of a tree at noon in the middle of summer. Mercury-vapor spectrum lines are apparent.

2. *3,500-deg. White*. Usually referred to as white, it has a tendency to over-emphasize the green and yellow pigments.

3. *Soft White*. This light is produced by a combination of pink and and daylight phosphors. It is warmer in hue than the other whites and slightly emphasizes the blue and pink pigments at the expense of the yellow and green. This lamp is less efficient than the others.

The table shows the effects of fluorescent and incandescent light upon different colored wall paints. Observers were requested to record their reactions and preferences.

The illumination in any room is partially dependent upon the amount of light reflected from the walls and ceilings. Light ceilings make for high efficiency. They should reflect approximately 75 percent of the light thrown on them. It has been found that for comfortable lighting the wall brightness should not be more than 25

Effect of Fluorescent and Incandescent Lighting on Color of Wall Paints

Colors of Paints Tested	Daylight Mazda F	3,500-Deg. White Mazda F.	Soft White Mazda F	Filament 100 Watt)
Cascade Blue (Pastel, bluish-green)	Bluish Green (Preferred)	Greyish green	Slightly greyish	Yellowish faded blue
Palmettc Green (Pastel, yellowish-green)	Fresh blue green (Preferred)	Yellowish grey	Slightly greyish	Yellowish pale green
Peach (Pastel)	Slightly pink (Good)	Normal (Slightly cold)	Normal (Slightly pinkish)	Normal Same as white
Blossom Pink (Pale)	Purplish Pink	Yellowish	Intensified	Yellowish
Maize Tan (Pastel)	Greyish (Cold)	Yellowish	Cream (Good)	Strongly yellow
Sun Tone (Cream)	Faded grey	Slightly greenish	Cream (Good)	Cream (Good)
Deep Cream (Williamsburg)	Bluish (Excellent)	Intensified (Good)	Slightly greyed (Good)	Yellowish (Fair)
Governor's Red (Williamsburg)	Slightly bluish (Good)	Yellowish (Good)	Warmer (Good)	Yellowish (Good)
Deep Blue (Williamsburg)	Vivid (Good)	Richer (Good)	Vivid Blue (Preferred)	Greyed
Dusty Rose	Bluish	Yellowish	Vivid (Preferred)	Yellowish
Deep Yellow	Grey (Unattractive)	Vivid	Greyish (Good)	Reddish

percent of the brightness of white paper on the horizontal working plane. Another way of putting it is that the walls should reflect about 50 percent or a little more of the light that hits them.

Therefore, for almost any interior a light ceiling, usually white, is best for all types of lighting. The same is true for walls, except that reflection from walls in line with workers' vision must be taken into consideration. Usually, therefore, a slightly darker hue of a light color is chosen to decrease wall brightness.

Light walls and ceilings help to diffuse light and, by scattering it, soften and eliminate shadows. They also assist in lessening glare. Important from the latter standpoint is the type of reflection possessed by a paint. The flat or mat surfaces are best because of their diffused reflection characteristics. Highly polished or glossy surfaces, such as shiny metal machine parts, glazed paper, glossy desk tops, and slick-surfaced enamel paints, often produce reflected glare, particularly when the artificial light source is of relatively small size and high brightness.

Fluorescent lamps, because light comes from the tube walls and not from a point source, have proved valuable in supplying even, diffused illumination free from glare. Incandescent and mercury-vapor lamps may be just as satisfactory in this respect, provided the installations are carefully engineered.

Contrast is also important. The visibility of any object depends not only upon its own brightness but also upon the brightness of its surroundings. Difference in the reflecting characteristics of the object or material and its background produces the difference in brightness that makes discrimination possible. The situation is complicated, however, by the mutual effect of the two brightnesses on each other. For instance, a streak of gray paint on black will appear lighter than a streak of the same paint on white.

Three-Dimensional Seeing

This matter of contrast is the basis for work on what is known as three-dimensional seeing now being done by lighting engineers and paint manufacturers. Machinery is painted so that there is a contrast between working areas of machines and the remainder of the equipment. This contrast makes for improved efficiency and safety, since the eye is naturally attracted to light colors in a drab field of vision. Colors recommended are a medium gray for the body of machines and buff for working surfaces.

The same principles may be applied to an entire shop, so that dark masses of machines do not blend together against a similarly dark background. Contrasting light colors for ceilings and walls are recommended. A well-lighted interior with light ceilings and sidewalls, plus machines painted in two colors, makes a complete three-dimensional seeing set-up.

In choosing paints for any interior there are a number of things to be debated and decided. To get the most from both paint and light, the following points must be given careful consideration:

1. Where is the paint to be used—on ceiling, walls, machines?

2. What kind of lighting is used—fluorescent, mercury-vapor, incandescent? What are the color characteristics of the light selected? What's the intensity?

3. Is the paint durable?

4. How about maintenance? Does the paint get dirty quickly? Is it washable or otherwise easily cleaned?

5. Are the combinations of colors pleasing? What are the reflection factors of these colors?

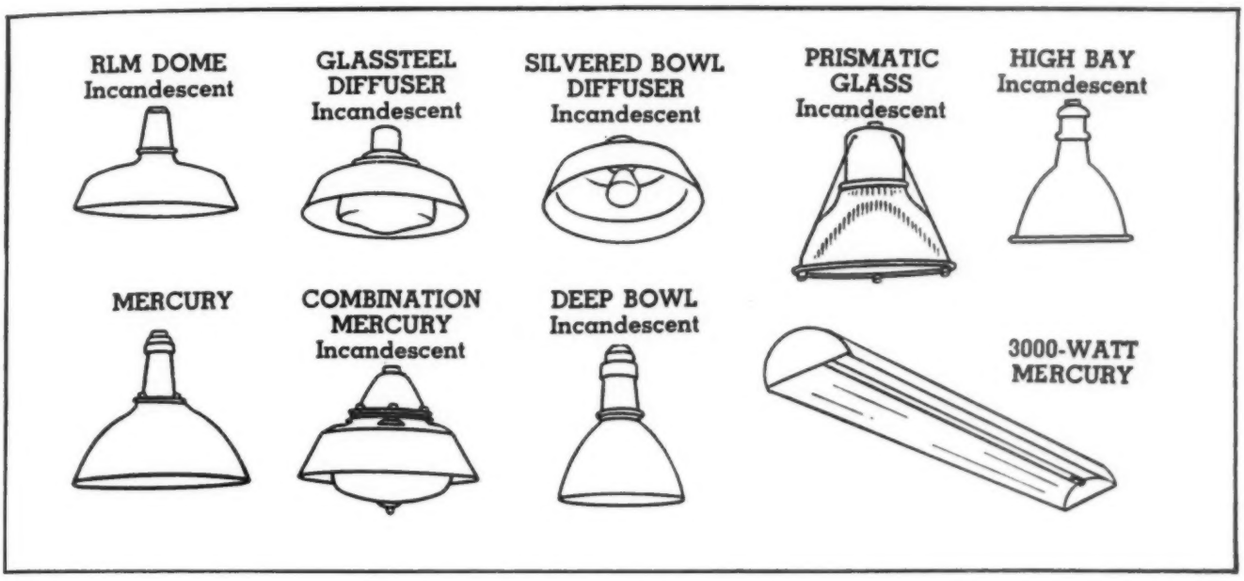
6. How about the paint surface? Is it desirable from the standpoint of type of reflection?

Every paint and lighting job is individual and should receive the attention and cooperation of paint experts and lighting engineers for thoroughly satisfactory results. By helping production to do a better job, good lighting and painting will pay for themselves in an unbelievably short time.

Fluorescent fixtures on 8x8-ft. centers, holding two 40-watt lamps, deliver 30 foot-candles

Guth photograph

What's What in Fixtures



These types of reflectors are designed to be used with incandescent and mercury-vapor lamps

LUMINAIRES OR REFLECTORS are designed to redirect and in certain instances diffuse the light as well as shield the source, in order to provide the comfortable, high-level illumination that is such an important feature of the modern, well-lighted plant. Quality of a lighting installation, as judged by the effect produced at the point of seeing, is almost entirely dependent upon the selection and placement of the lighting equipment. It may, therefore, be said that reflectors are a concrete expression of the philosophy of good lighting as well as its practical limitations.

A great variety of industrial reflectors are available. They can be classified into relatively groups.

For Filament Lamps

Open dome-type porcelain-enameled reflectors were used for many years in the majority of industrial applications. They were durable, easy to maintain, inexpensive. White-bowl lamps were designed especially for use in them. With these lamps relatively comfortable illumination can be obtained up to 15 or 20 foot-candles. When clear or inside-frosted lamps are used, direct glare is severe. Such lighting is recommended only for aisles and storage areas, where seeing tasks are simple and infrequent.

Glassteel diffusers are direct-lighting reflectors in which the lamp is inclosed in a glass globe sufficiently large to reduce its brightness to acceptable values. This unit has a small indirect component that lightens the ceiling and reduces contrast between bright reflector and background. Such units provide the best quality of lighting available with incandescent lamps. Principal drawback to these reflectors is relatively rapid depreciation due to dirt collection and the difficulty of cleaning and relamping.

Reflectors for silvered-bowl lamps are porcelain enameled and are one of the most practical reflectors available for filament lamps. The quality of lighting is high since all the light is directed into the reflector, from which it is directed to the working plane. In case of cleaning and relamping, these units are comparable to the open-dome reflectors. Despite the higher cost of the silvered-bowl lamp used in this unit, the over-all cost of light is less than with other high-quality filament fixtures because of the greater efficiency of the reflector.

Angle-type reflectors are usually porcelain-enameled and designed to direct light to one side. They are often used at the sides of craneways where they can be inserted below the crane rails. This unit is not recommended for the majority of installations of this type where reflectors mounted above the crane provide more suitable brightness conditions.

Concentrating reflectors for mounting in high, narrow bays are available in prismatic and mirrored glass. Such open reflectors also are available with somewhat wider distributions for lower mounting heights.

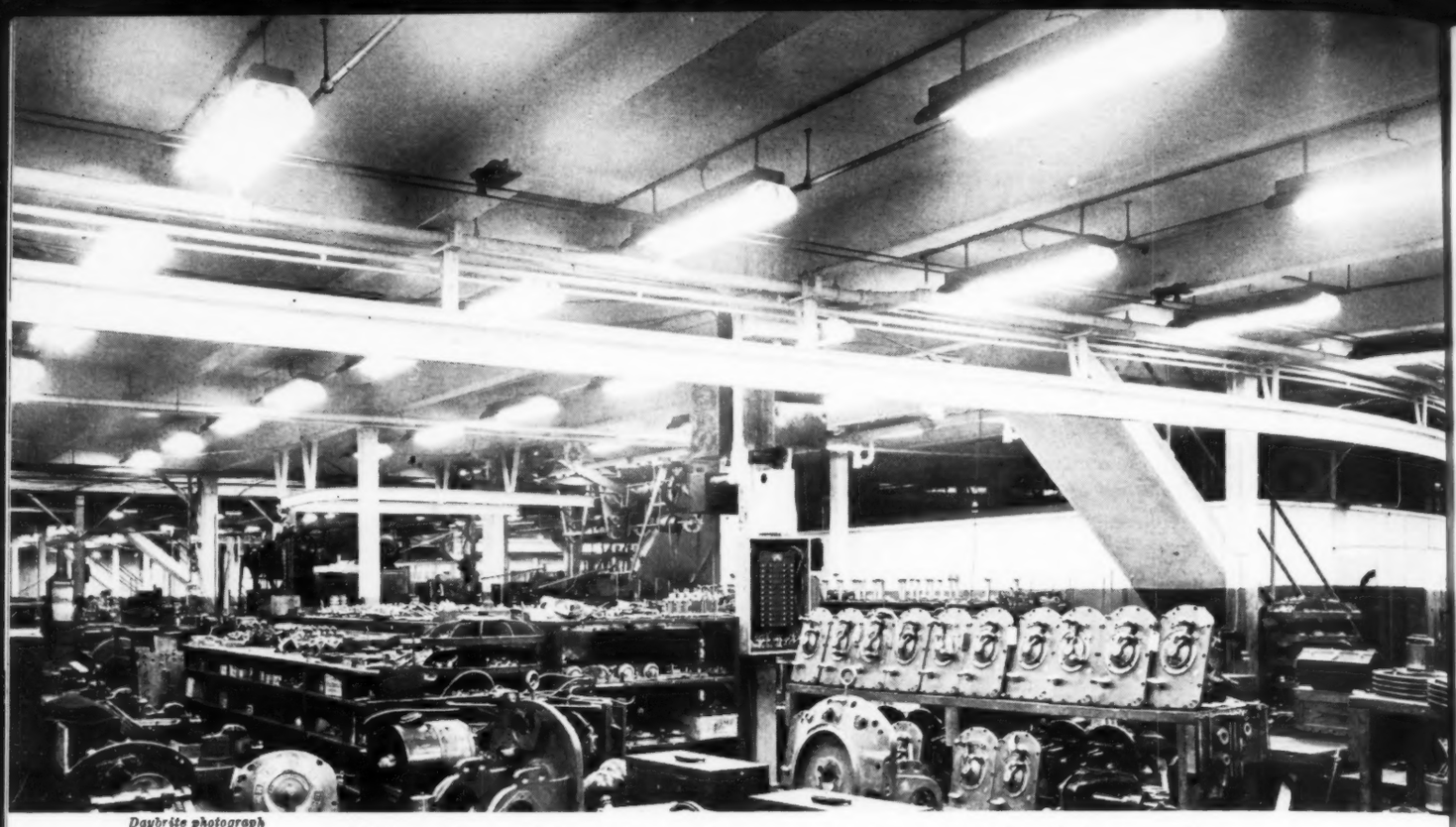
For Mercury Lamps

The 400-watt mercury lamp is the most generally used lamp of this type. Available reflectors include open-dome, Glassteel diffusers, and concentrating high-bay equipment. Quality of lighting—that is, distribution of brightness in the visual field—is comparable for mercury and filament lamp systems, since the light source is relatively concentrated. Hence the preceding discussion applies also to mercury lamps.

A 3,000-watt mercury lamp has recently become available. Because of its great light output and high brightness, presently available equipment is recommended for mounting heights above 35 or 40 feet. This lamp produces light at a lower over-all cost than any other illuminant.

For Mercury Filament

A combination of mercury and filament lamps (in approximately equal wattage) provides illumination that is superior in many respects to either alone. The color becomes a "white" that blends well with daylight, is psychologically cool, and does not unduly distort complexion values. Stroboscopic effect is reduced. Perhaps of greatest importance, light from



Daybrite photograph

Spaced 8x9 on a 12-ft. ceiling, 106 two-lamp fluorescent fixtures provide 40 foot-candles

the filament lamps is available immediately following a voltage fluctuation.

Combination lighting is obtained most efficiently by placing the two sources in alternate outlets. Recently dual reflectors have become available, with which the two sources are placed in separate reflectors at the same outlet. Both arrangements are good, since reflectors (particularly non-diffusing) handle the output of a single lamp only at maximum efficiency. An installation of alternate mercury and filament lamps should be restricted to mounting heights in excess of 20 feet, to minimize the possibility of annoying color shadows and pools of vari-colored light.

There has been widespread application of units that combine both light sources in a single reflector. Usually several relatively low-wattage (100-, 150-, 200-watt) filament lamps are used with a 400-watt mercury lamp. The efficiency is satisfactory with open diffusing reflectors, but most concentrating equipment suffers a loss that is often 10 percent or more. In addition, the problem of lamp replacement is intensified by the use of several small lamps instead of one large one. For lower mountings, use of such lamps is necessary to obtain proper blending of the two colors.

For Fluorescent Lamps

The low surface brightness and large size of the fluorescent lamp permit use of open reflectors that provide an excellent quality of lighting. Such reflectors are highly efficient since they are essentially shields of high reflection factor. The reflector should provide a shielding angle of at least 15 degrees at right angles to the lamp. The lamps are then placed crosswise to the normal viewing position of the majority of the workmen. Without the crosswise shielding the cumulative glare effect of a large fluorescent installation in which the lamps are exposed can be very annoying. Shielding lengthwise of the lamp is less essential.

Fluorescent reflectors require an inclosure that holds the necessary ballast, lampholders, and wiring. This housing has been extended to form a continuous wiring channel that contains the accessories and supports the reflectors. Such construction offers many advantages in reduced installation costs since most of the secondary distribution wiring is in the lighting equipment channel.

The quality of light provided by such an installation is excellent. Reflected brightnesses are more uniform and can often be utilized for increased visibility of the work.

Accessories have been developed for fluorescent lamp reflectors to increase their value for unusual industrial applications. Louvers are available that provide additional shielding both lengthwise and crosswise of the lamp. Many factory offices are being so lighted.

A new product for use with these reflectors is a plastic cover plate with louvers built into the plastic. Such louvers are highly recommended for specialized inspection applications where the reflectors may be mounted close to the head of the inspector. The louvered plastic entirely eliminates direct glare.

Vaporproof and dust-tight reflectors are in great demand in many of the war industries. A complete line of fluorescent reflectors meeting such specifications is available.

Supplementary Lighting

The approved method of obtaining illuminations greater than 50 to 60 foot-candles is with supplementary lighting reflectors added to a general lighting value of not less than one-tenth the maximum desired. For many years small filament lamps were used, but the results were only partially satisfactory. The unit had a high surface temperature; it usually illuminated too small an area; if not carefully located, it caused glare.

The fluorescent lamp is ideally suited to most supplementary lighting applications. The reflector is cool, and no difficulty is experienced with either radiant or conducted heat. The source is large with respect to the area lighted and of low brightness so that reflected glare is reduced to a minimum. The smaller lamps must not be expected, however, to light more than a limited area.

The following fundamentals must be carefully considered when selecting types of equipment and light sources. Specific installations will differ widely

in the emphasis that must be given to the various factors, but intelligent selection requires that all of them must be carefully considered.

1. *Desirable distribution of light and suitability for the particular interior involved.*

Does the unit minimize reflected glare? Many well-shielded direct-lighting units are highly suitable where there are few surfaces that will reflect light specularly. Where specular surfaces are encountered, as in tinplate mills, sources that have relatively low brightness are mandatory.

Will vertical and oblique surfaces be well lighted? There has been a wide use of concentrating reflectors in high, narrow bays for increased utilization of light on a horizontal plane. Diffusing units direct more light to the walls, with consequent poor utilization of light at the working plane. In areas where lighting is principally for safety and convenience, this type of illumination is suitable. Where there are critical working areas on vertical or oblique surfaces, it is highly desirable to use more-diffusing, general lighting equipment or to add supplementary lighting directed to the working surfaces.

Will there be undesirable shadows? In drafting rooms and industrial areas where machinery is likely to cast concealing shadows at the point of seeing, well-diffusing reflectors minimize this hindrance. Number and placement of units also are important.

2. *Efficiency of light output.* Efficiency is rated, broadly, in over-all satisfactoriness or achievement of effect. There are available many reflectors that may have essentially the same distribution, but which will vary considerably in efficiency of light output. Other things being equal, the most efficient unit should be selected.

3. *Retention of initial efficiency and ease of maintenance.* Good design results in relatively less depreciation due to the collection of dirt upon the lamp and reflecting surfaces. For example, some types of reflectors provide essentially the same quality of light as others, but there may be considerable difference in the ease of cleaning and relamping.

Fluorescent reflectors, particularly types used in offices and drafting rooms, also show a wide variation in this respect. Commonly used direct-indirect luminaries that have the lamps mounted on a simple frame entirely open to the ceiling for the indirect component, and with an egg-crate louver of vertical elements to shield the direct component, have practically no surfaces that will collect dirt except the top of the lamps. Thus much better maintenance characteristics will be obtained than if, for example, the fixture included horizontal glass elements under the lamps that will collect dirt. There is also a wide variation in ease of lamp replacement with fluorescent reflectors.

4. *Adaptability to greater light output.* There is every indication that a long-term trend toward higher intensities is being accelerated with the advent of new, more efficient light sources and reduced operating cost. With filament lighting provision for higher levels is frequently made by the use of equipment that will permit the addition of a large lamp when desirable, plus adequate wiring capacity to handle heavier loads.

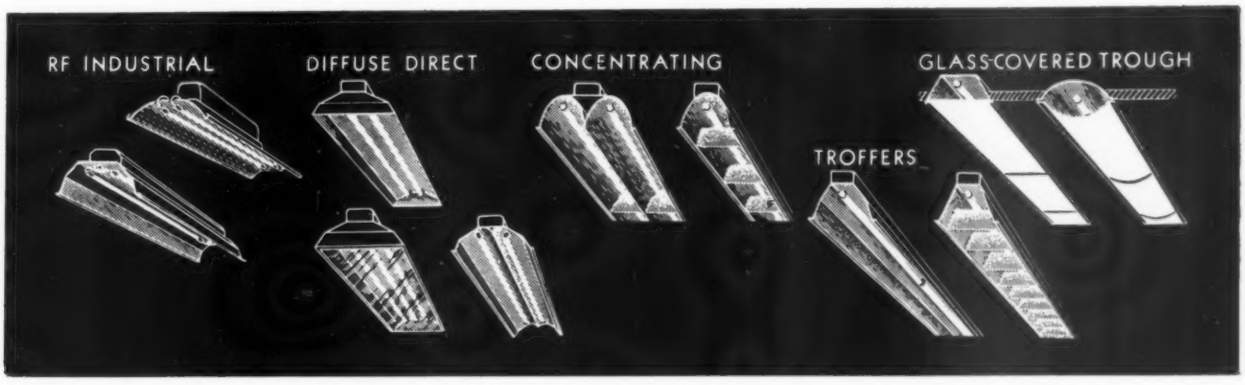
Fluorescent lamps, however, present a somewhat different problem since each lamp wattage is available in a different length and ballasts must be designed for each specific lamp. Progress has been made, however, particularly with continuous-channel, direct industrial reflector systems. The original installation is frequently made with two 40-watt lamps per reflector. The reflector is punched and the channel designed so that the addition of a third lamp is relatively inexpensive. The additional third lamps, in adjacent reflectors, are connected to a two-lamp ballast mounted midway between the two reflectors in the wiring channel. Thus the same equipment will provide a 50 percent increase in illumination.

5. *Sturdiness of construction and permanence of reflecting surface.* Diffusing reflectors are most widely used in the industrial field. For filament lamps porcelain-enameled steel has had almost universal acceptance because of its durability, ability to withstand high temperatures, and the retention of high reflectance values when cleaned under adverse conditions.

In the past two years synthetic enamel finishes have assumed an important place in the industrial reflector field. They are particularly good with the lower operating temperatures experienced with fluorescent lamps. High-bake synthetics will withstand frequent cleanings where abrasives are necessary to clean the reflectors or where the dirt accumulation itself has abrasive action.

Alzak aluminum is by far the best of the specular metallic finishes. It is easily cleaned, durable, and relatively inexpensive. For the duration of the war little aluminum will be available for lighting purposes.

Glass, both prismatic and mirror, is also widely used for industrial reflecting equipment where control is essential. Such reflectors are permanent and durable, easily cleaned. Relatively little difficulty has been experienced with glass breakage, and careful design has minimized the possibility of falling glass, even if the reflectors should be broken.



Reflectors for fluorescent lamp installations are available in such typical designs as these

How to Check Lighting

YOUR LIGHTMETER can tell you the answers—if you use it properly—to many such questions as: Are the workmen getting enough light for maximum productive efficiency? Do the light fixtures need cleaning? Do the walls need cleaning or repainting? How often should windows be cleaned?

One fact should be emphasized. The lightmeter is a practical device of the greatest simplicity. It is not designed to split foot-candles. Manufacturing tolerances may result in a variation in readings of ±7.5 percent, and although most lightmeters register within much closer limits, there still is some variation. This variation, however, does not affect the utility of the meter.

Whether the light is properly directed to the work can be checked by pointing the meter in different directions from that point. Comparative readings can be taken in different areas and checked to see whether they bear any relation to production levels or percentage of defects.

To check reflection factor of a wall, hold cell end of lightmeter 2 to 4 inches away from the wall and take the resulting reading

First consideration for factory lighting is a reasonably uniform level of general lighting. That uniformity helps to minimize shadows and makes possible the utilization of every square foot of floor space.

To determine whether the distribution of lighting units has been well planned, take several foot-candle readings—under the fixtures, between them, on top of the machines, behind them, in the center of the room or bay, and near the walls. You may be surprised to discover a number of dark spots that need more light.

In addition to revealing undesirable dark spots, a sufficient number of measurements in various parts of the area will give a good idea of the average general illumination.

Workers need plenty of general illumination and they also need light at the point of work. In factories having bulky machinery general lighting may be insufficient because of obstacles that get in the way of light. Supplementary lighting may be needed in this type of plant, just as in other plants where high lighting levels are necessary for efficient production.

The lightmeter tells how much light is being provided, but it does not tell what the intensity should be. Another instrument is available for that purpose. It is essentially a box with a high-power photoflood lamp and a hand-operated variable shutter. Point it at any working plane and manipulate the shutter until the plane is illuminated by the amount of light considered most desirable. Then the foot-candle level selected is measured with the lightmeter.

Check foot-candle readings immediately after fixtures have been cleaned, and then at intervals thereafter. Note the decline in light output as the fixtures get dirty. The result may show that it would be profitable to clean them more often.

One engineer used his lightmeter to determine how often plant windows should be cleaned by measuring the light transmission of the panes. Accumulations of dust and dirt on the inside were found to be cumulative, but rain kept accumulations on the outside from going beyond a certain point. Hence it was profitable to establish a window-washing schedule that called for more frequent washing of the inside of the panes than the outside.

Another frequent use is to measure the reflection factors of wall surfaces, to determine whether walls need washing or repainting.

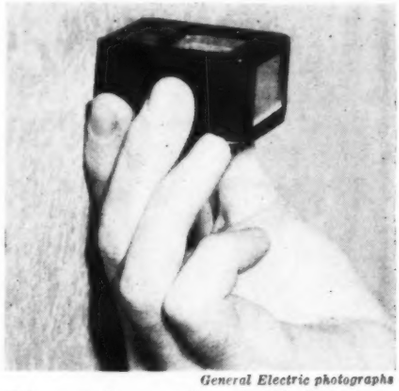
A lightmeter consists of a light-sensitive cell combined with a microammeter. Light falling on the cell generates enough current to operate this meter.

One difficulty is inherent in all light-sensitive cells: Their response to the wavelengths of light emitted by the various sources does not coincide with the response of the human eye. The lightmeter is calibrated under a standard light source of known color temperature. Then correction factors or a filter must be applied when the cell is used to measure light from other light sources. The generally accepted standard light source is a tungsten filament lamp operating at 2,700 degrees Kelvin.

Correction factors can be obtained from the manufacturers.

Apart from differences in light sources there are other factors that affect the performance of the light-sensitive cells in lightmeters, such as fatigue, temperature, output in microamperes versus light on the cell surface, effect of resistance in the external circuit. Errors from these sources are usually small, and there is no need to worry about them. Complete technical data can be obtained from the manufacturers.

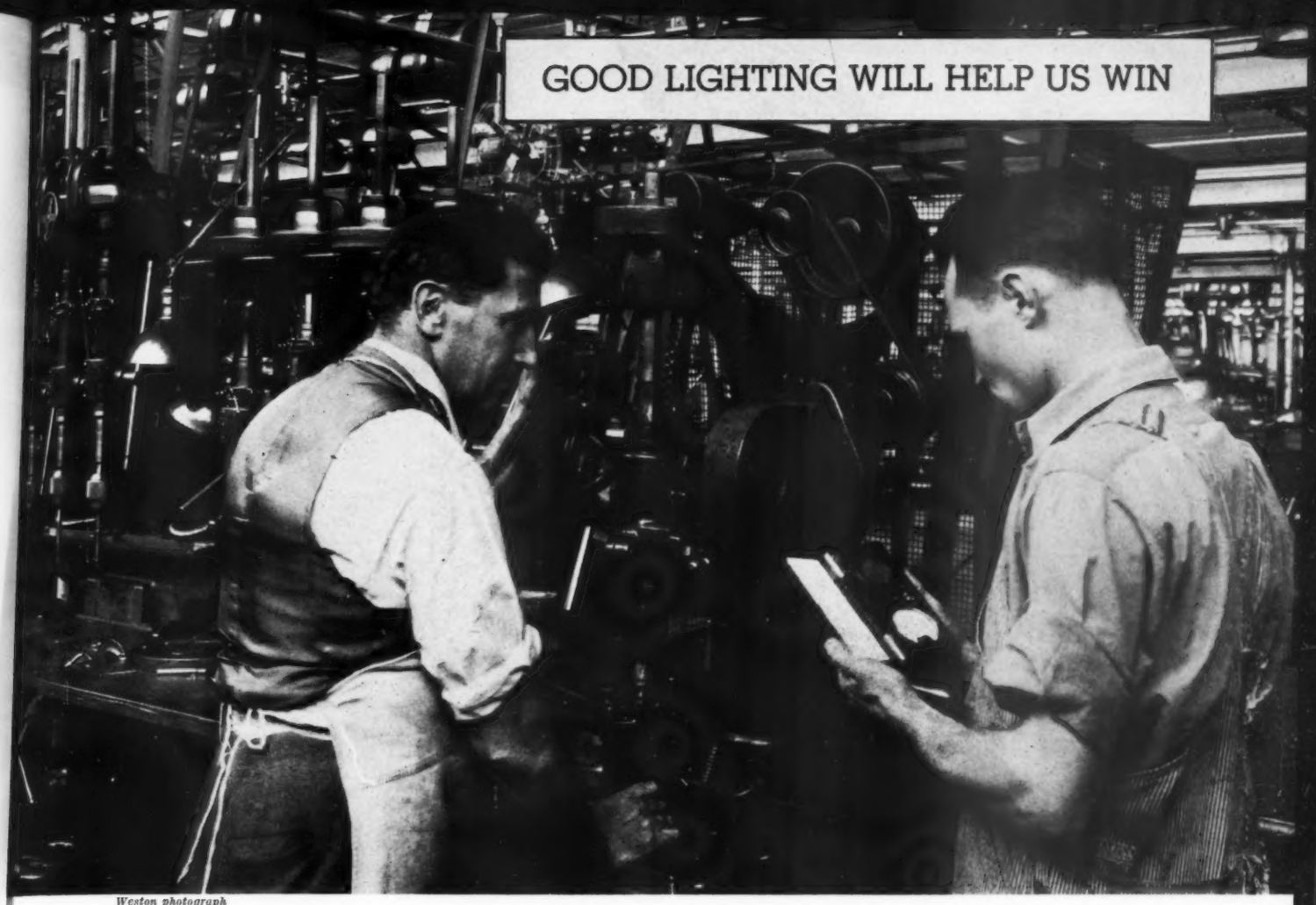
A lightmeter undergoes no permanent change due to fatigue, but there is a slight change under continued exposure—most of it in the first 15 minutes. Therefore it may be desirable to expose the meter for 15 or 20 minutes before starting to take readings. In taking measurements, the surface of the cell should be parallel to the surface being measured, regardless of whether it is horizontal, vertical, or oblique.



General Electric photographs

Then take reading with bottom of meter against wall. Reflection factor is the first reading divided by the second

Be careful that part of the body does not obstruct the light falling on the meter. Also, realize that a white shirt or other nearby reflecting surface such as a wall can throw an appreci-



Weston photograph

When operators complain about light, it doesn't take long with a lightmeter to get the facts

able amount of light into the meter and thus affect the foot-candle reading. Naturally, the glass cover over the cell must be clean.

When the meter is used in a large room, remember that some of the light striking the glass cell cover at an oblique angle will bounce off the glass and thus will not be registered on the meter.

When the reflection factor of walls is being checked, the surface to be measured should not be less than 12 inches in either dimension. Hold the cell of the lightmeter against the surface and then draw it back slowly until the needle assumes a point where further backward movement makes little appreciable change in the reading. This point will probably be found within a range of 2 to 4 inches from the surface.

Now turn the meter around, hold the bottom in contact with the wall, and take another reading. The approximate reflection factor is then obtained by dividing the first reading by the second one. A reflection factor of 50 percent is desirable.

Checking the light transmission of different types of glass is simple. Place the glass over the light-sensitive cell and take a reading. Remove the sample and take another reading. If the meter reads 20 foot-candles with the cell covered and 50 foot-candles with the sample removed, the glass sample has a transmission factor of approximately 40 percent.

The wide variety of present-day light sources with individual spectral characteristics calls for care in measurements of light intensity. Suppose you have a new fluorescent installation and want to estimate the maintained foot-candle output after a month's use.

As explained, the correction factor for the color of these fluorescent lamps must be considered. Measurements should not be taken until after a warming-up period of half an hour or an hour, to let lamps and auxiliary equipment reach a stabilized condition. Make sure that voltage is normal.

With a new installation, allowance must be made for the fact that the light output of fluorescent lamps decreases fairly rapidly during the first 100 hours of burning—perhaps as much as 10 percent. (Fluorescent lamp ratings are based on light output after 100 hours of burning.)

Also, there is a maintenance factor —lamps and fixtures will not remain spotlessly clean.

An actual example will illustrate the factors to be considered.

A new installation, designed to deliver an average maintained level of 35 foot-candles was found when first measured to deliver 80 foot-candles before a proper warm-up period. After this period, the foot-candles were reduced to 70. The point at which the reading was taken could not be considered as representative of the average level. When readings were taken at a sufficient number of points and averaged, the illumination was found to be 60 foot-candles.

Since the installation consisted of daylight fluorescent lamps, a multiplying factor of 0.90 had to be applied, which brought foot-candles to 54.

Again, lamps were new and would depreciate by about 10 percent after the first 100 hours, hence it was necessary to take 90 percent of 54 foot-candles, leaving 48 foot-candles.

Since these readings were made on new, clean fixtures and lamps, and the original layout was based on 75 percent average maintenance, the final average level was estimated to be 75 percent x 48 = 36 foot-candles. As mentioned above, the installation was designed for a maintained intensity of 35 foot-candles.

How to Maintain Lighting

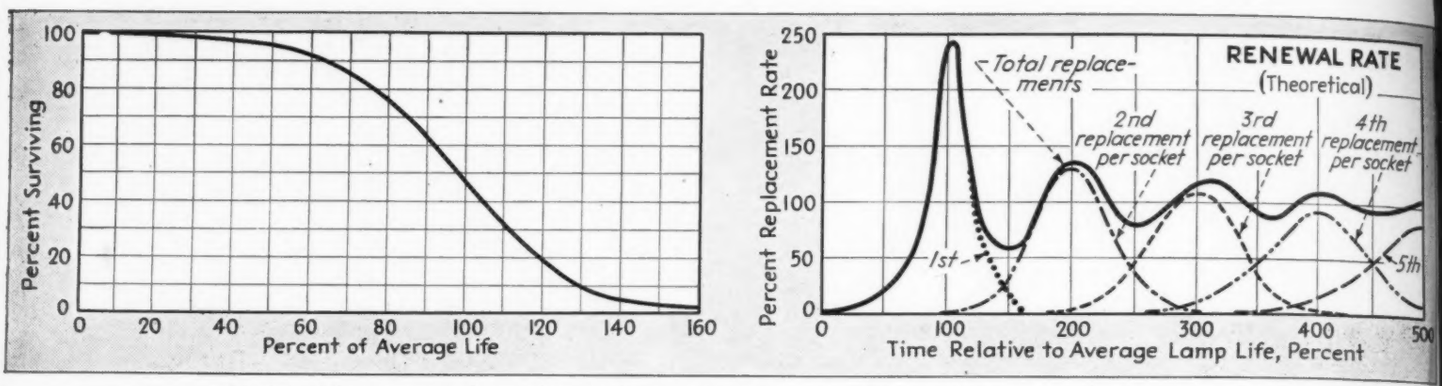


Figure 1 (left). Fluorescent lamp life follows this curve . . . Figure 2 (right). Renewal rate for fluorescent installations shows sharp peaks before it levels off to average rate

SOAP AND WATER are as important to a lighting system as they are in the factory washroom. Dirt and dust on lamps and fixtures can reduce total light output by 30 percent. A factory in Pittsburgh, for example, may have to have fixtures washed every week. In New York or Cleveland, on the other hand, a washing job every six months may be sufficient if the lamps are wiped with a cloth once or twice in the interval. Common sense will determine the cleaning schedule.

Six months ago a plant may have had sufficient voltage for the new lighting system that was installed. Full rated illumination was obtained from the lamps. Since then new electrical machinery may have been added or additional lamps installed. If so, voltage on the line may have dropped with the result that lights, whether they be fluorescent or incandescent, are not burning at full brilliance.

A check of the voltage should be made at the time a lighting system is installed and whenever new loads are put on the plant's wiring system. This precaution is particularly important with fluorescent installations, since insufficient voltage not only lowers light output but can shorten the life of the lamps and cause trouble in starting.

The color of walls and ceilings has a definite effect on illumination. Dirty walls and ceilings can reduce the efficiency of a system as much as 20 percent. Therefore, choose light colors and keep walls and ceilings clean.

When an incandescent lamp fails to light it usually means that the lamp has burned out. This is often not true of a fluorescent lamp. When it fails to burn properly, or goes out altogether, replace it with a new lamp. If that doesn't work, put in a new starter switch. If the lamp still remains unlit, look for trouble in the ballast or transformer.

In plants where a large number of fluorescent lamps are installed, the problem of relamping becomes serious unless a program is worked out to anticipate the number of lamps that will fail at a given time. It is impossible to predict when each lamp will burn out, but it is easy enough to predict the number of lamps that will fail in a given group used in any period of time.

Based on lamp mortality curves, with new installations:

1. About half the lamps will burn out at the average life point.

2. A few lamps will burn out quite early.

3. A few lamps will live far beyond the life expectancy of the group.

4. The rate of failure varies widely, rising gradually to a peak at the average life point, then diminishing as new lamps are installed.

Replacements Needed

Therefore, the plant with a new installation must have enough men and lamps to meet what will seem like a barrage of outages. Figure 1 shows the mortality curve of fluorescent lamps, for new installations. In Figure 2 the renewal curve shows that the replacement rate for any given installation varies widely for the first few lampings and then levels out to an average rate determined by the number of lamps, type of lamps, and hours involved. To determine the number of replacements needed on any installation for a month or a year multiply the number of hours burned by the number of lamps and divide the total by the rated hours of lamp life.

Consider a large plant where 10,000 40-watt fluorescent lamps have just been installed to burn 20 hours a day, 25 days a month. The formula just given (6,000 hours a year times 10,000 lamps divided by an average life rating of 2,500 hours) shows that 24,000 lamps will have to be replaced yearly, or about 2,000 a month after the first few relampings.

But 2,000 replacements a month are only about half the peak replacement rate that occurs at the end of the first 2,500 hours of service and again at approximately 5,000 hours. Hence, whereas 80 lamps a day would be replaced after the replacement curve levels out, more than 130 lamps a day will need to be replaced during the first peak period, about the fifth month. The second peak will come during the tenth month.

The maintenance engineer must anticipate the average renewal rate, and also plan to handle the peak load when it comes.

When a fluorescent lamp begins to blink, consider it a danger sign. It means that the emission material on the lamp electrodes has worn off, causing a high voltage to develop inside. This blinking should not be permitted to continue for more than an hour or so. If it does the starter switches may be destroyed, and the ballast equipment may easily become overheated and damaged.

Because quick replacement of blinking lamps is all-important, the maintenance man should have: (1) ready access to fixtures; (2) proper fixture design for quick relamping; and (3) facilities to meet peak replacement periods quickly and efficiently.

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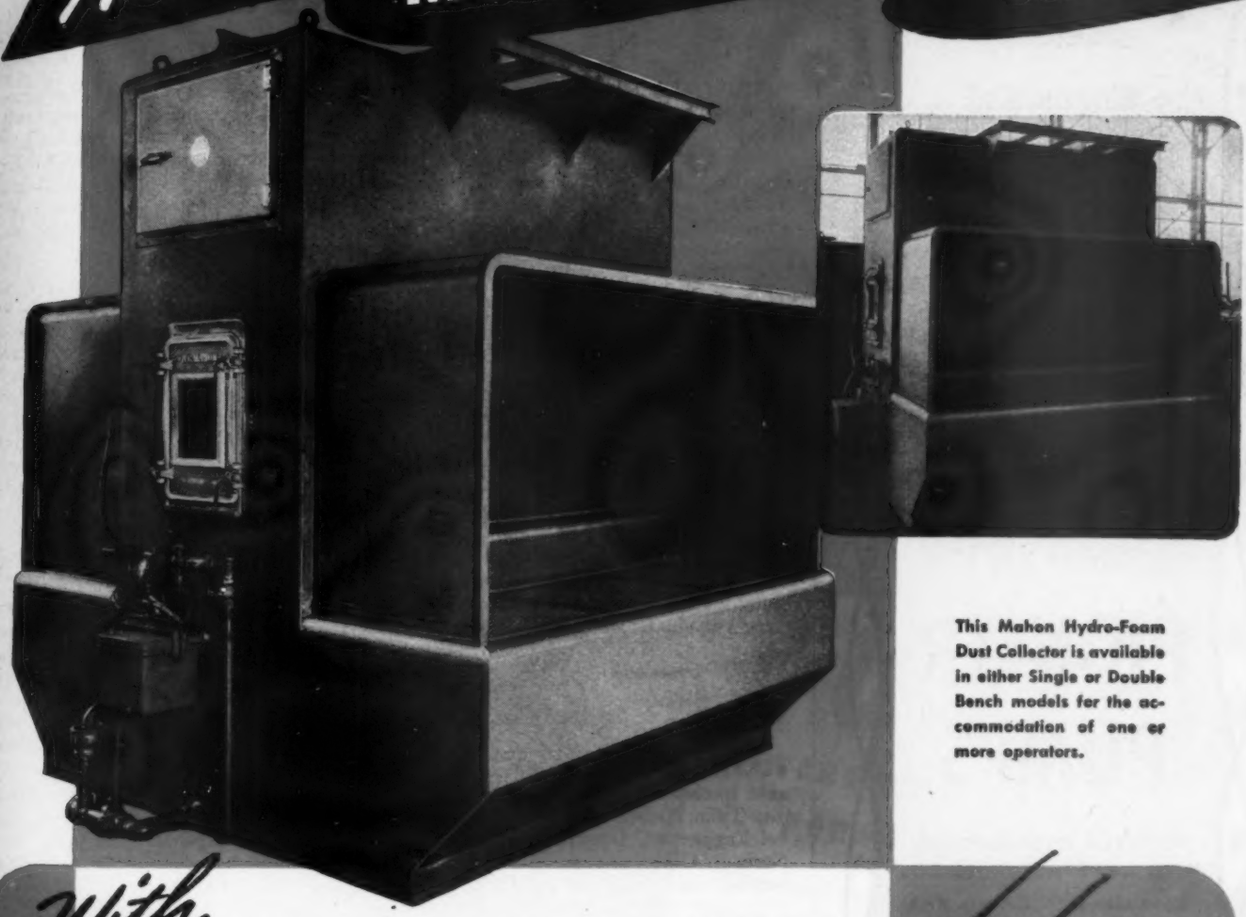
Avoid MAGNESIUM DUST FIRES



This Mahon Hydro-Foam Dust Collector is available in either Single or Double Bench models for the accommodation of one or more operators.

With THE MAHON HYDRO-FOAM DUST COLLECTOR

If you grind—buff—or polish—magnesium alloy castings in your plant you have one of the greatest potential fire and explosion hazards known. Magnesium dust can ignite from the smallest spark—with mighty disastrous results. Dust collecting systems, that convey the dust through ducts to a distant point, provide little or no protection. *Magnesium dust should be immersed in water—immediately.* That is exactly what the Mahon Hydro-Foam Dust collector, pictured above, accomplishes. In one compact Unit there is embodied a hooded, ventilated work bench combined with a mechanism for depositing this dangerous dust *under water.* Operation is remarkably simple. Merely start the exhaust fan (the only moving part) and all dust, chips and shavings are instantly drawn through a wooden grillage set in the bench and completely submerged in a tank of water directly below. The Unit is portable and may be set up anywhere that water, sewer and electrical connections can be made. You will surely want to know about this latest development of Mahon engineers that is so essential to safety wherever magnesium alloy castings are processed. Write for complete particulars—at once.

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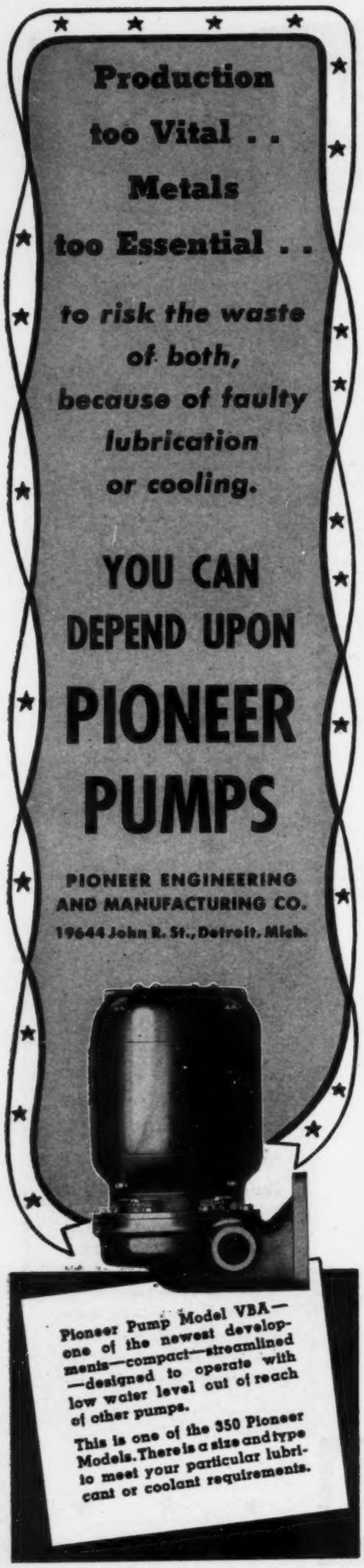

YOU WANT TO KNOW

more about the items mentioned on this page

Letters to the addresses given will bring information

• PHOTOFLASH LAMPS supply invisible infra-red light and so make picture taking possible during blackouts. Specially treated glass bulbs do not pass ordinary light but permit unseen infra-red rays to pass. Two types: one the size of a tennis ball, the other as small as a walnut. Westinghouse Electric & Mfg. Co., East Pittsburgh.

• TO CUT THE COST of hiring and training business employees you may have considered using ability and aptitude tests. A 16-page booklet explains the plan followed by The Personnel Institute, Inc., 225 North Wabash Ave., Chicago, in building tests for all types of sales, executive, clerical, and production jobs.

• "VITAMINS FOR DEFENSE." Booklet discusses effect of malnutrition on industrial workers—its relation to absenteeism and poor work. Recommends three vitamin tablets per worker per day and outlines major vitamins and essential minerals obtained in tablets offered by The William T. Thompson Co., Los Angeles.

• INFRA-RED PHOTOGRAPHS of weld specimens have been noted by William Tiffin, Assistant Professor of Mechanical Engineering, University of Oklahoma, Norman, Okla., to show greater contrast between weld metal and metal adjacent to the weld, better definition of the zones within and adjacent to the weld that are affected structurally and chemically by the welding heat, and a clearer definition of the outlines and extent of defects and impurities, as compared with photographs made with white light as the illuminator.

• BECAUSE THE GOVERNMENT requires all those holding war contracts to file duplicate copies in Washington, and because manufacturers are not always familiar with the required forms and specifications, The Frederick Post Co., Hamlin & Avondale Aves., Chicago, is prepared to supply through a special process, the required originals. Requests on letterhead, signed by a company official, should state the government department involved.

• IN'S AND OUT'S of subcontracting are fully explained in a 68-page booklet outlining methods of meeting the problems of both primary contracting and subcontracting. It was prepared in the interest of stabilizing employment and is based on the practices of 28 companies. Policyholders Service Bureau, Metropolitan Life Insurance Company, New York.

• DIGEST OF CURRENT PRACTICE in selecting employees has been prepared for use by companies expanding their personnel under the pressure of war orders. Based on present experiences of

NO FLYING GLASS or splinters when glass is coated with a transparent, colorless liquid that has held the fractured glass intact in the frame under explosive and concussive tests set up to be as like air raid conditions as possible. Cleanable with mild soap solutions. Roxalin Flexible Finishes, Inc., Elizabeth, N. J.

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"INCREASED TOOL LIFE 200% ... PERMITTED HIGHER P-Q*."
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Van Dorn Tools are available from leading jobbers in key cities, who will gladly demonstrate them to you in your own plant, on the actual work. Van Dorn's 26 factory-owned service branches, located throughout the country are a "plus" service to prevent costly production delays when tools need repairs or overhaul. For complete Van Dorn catalog, write: The Van Dorn Electric Tool Co., 719 Joppa Road, Towson, Maryland.

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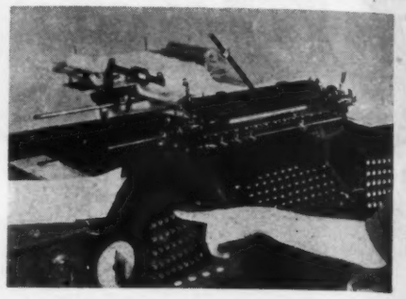
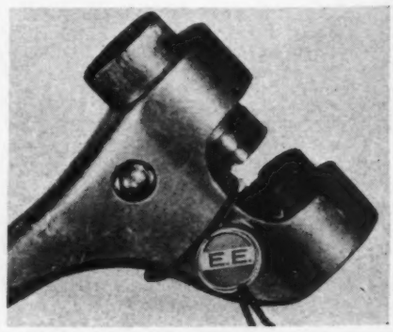
a large number of representative concerns. 20¢. Industrial Relations Section, Princeton University, Princeton, N. J.



DETAILED ORDER-WRITING and billing operations that slow up shipping orders can be typed quickly with an automatic machine employing push-buttons for selection of special paragraphs, fill-ins, indent lines, and other repetitive information. Billing typewriters, manual or electric, can be attached. American Automatic Typewriter Co., 614 North Carpenter St., Chicago

• EMPLOYEE ORGANIZATION for fire safety is discussed in an illustrated booklet emphasizing what every employee must know, things a department head must do, the plant manager's responsibility. Includes a section on air raid evacuation drills, treatment of incendiary bombs. 25¢. National Fire Protection Association, 60 Batterymarch St., Boston.

• PLANT AND OFFICE employees wearing tamperproof identification buttons with photograph can be readily recognzed by guards as bona fide members of the organization. Buttons are over two inches in diameter, washable and unbreakable. Parisian Novelty Co., Dept 13, 3510 South Western Ave., Chicago.



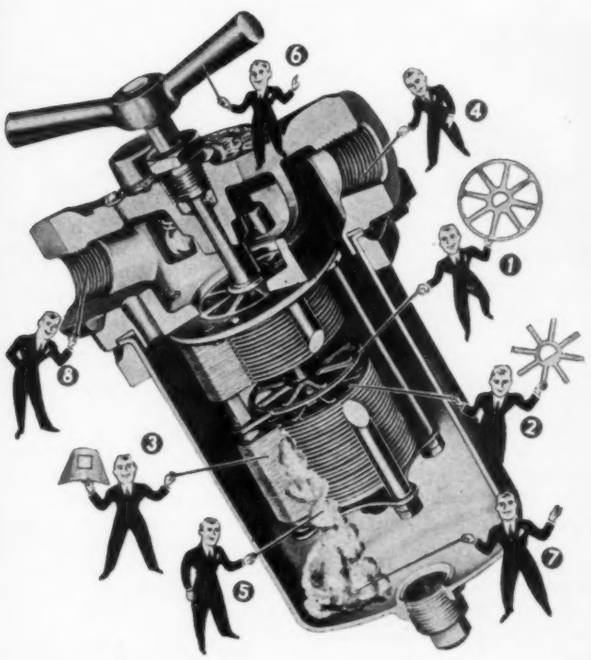
ANY ATTEMPT at breaking open this safety seal once it has been affixed to inspected fire extinguishers, sealed drums and containers, parts on their way to the assembly line after inspection by the Army or Navy is easily detected. Special pliers lock together the three components—preshaped metal seal-cup, multi-color-printed disk, and string, cord, or two-ply wire. Stoffel Seals Co., Inc., 188 Water St., New York

Even if your fluid-cleaning requirements are different from these four cases, you'll find here the reasons why a Cuno will probably do the job best.

CUNO AUTO-CLEAN FILTER

Cleanable (manually or automatically) without interrupting fluid flow • • Non-collapsible, all-metal construction • • Minimum pressure drop • • Permanent filter element — no cartridge to replace • • Obviates duplex installation • • Cleaned by *combing*, not scraping • • Minimum filter maintenance.

Made of any machinable metal in a wide range of sizes — small compact units up to massive motor-driven models—to handle fluid, air, gas.



NO STOPS FOR CLEANING FLUID
NO STOPS FOR CLEANING FILTER

1. Wheel-shaped discs are stacked on a central rotatable shaft.
2. Discs are held apart by spacers conforming in shape to discs but without rim.
3. Cleaner blades stacked on stationary rod extend into slots between discs.
4. Fluid containing solids enters casing here . . . must pass between discs.
5. Solids larger than space between discs are retained on outer edges.
6. Turning handle by hand or motor causes discs to rotate past stationary cleaner blades.
7. Rejected solids fall to bottom of sump . . . drained when convenient.
8. Filtered fluid passes out here.

Naturally, the Cuno Filter has a wider range of application than the four services described at left. See column below.

On These Services Cuno "Filter-Fine" Strainers Remove Foreign Solids Continuously

Acids
Adhesives
Air
Alkali
Animal Oils
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Casein
Cleaning Solutions
Coatings
Compressed Air
Coolants
Cutting Oils
Dip Tank Systems
Enamel
Engine Fuel
Engine Lubricating Oil
Fuel Oil
Fuel Tar
Gases
Gasoline
Grease
Grinder Coolant
Hydraulic Oil
Ink
Japan
Lacquer
Lubricating Oil
Machine Tool Cutting Oil
Machine Tool Hydraulic Oil
Machine Tool Lubricating Oil
Nitrocellulose Solutions
Oils
Paint
Palm Oil
Paste
Pyroxylin
Quenching Oil
Resins
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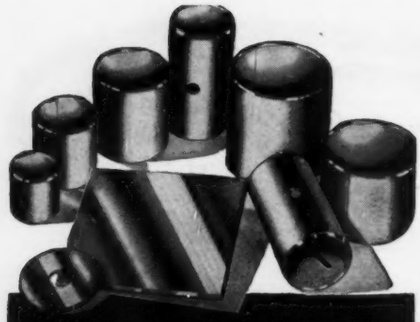

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Bronze on Steel

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This combination of a high grade bronze alloy with strip steel provides a new and unusual bearing material. In sleeve type bearings it enables you to increase speeds and loads . . . to gain longer bearing life and smoother operation . . . plus greater resistance to shock and to wear.

Pre-Cast Bearing BRONZE ON STEEL is a thin wall, laminated type of bearing. The manufacturing process, a series of stamping and forming operations, provides accuracy and precision plus a low unit cost.

While *Pre-Cast Bearing* BRONZE ON STEEL was developed primarily for sleeve bearings, it has already found many other important applications in industry. It is an ideal metal for stampings, washers or other flat pieces. Available in rolls . . . up to 400 feet in length . . . or as finished parts, made to your specifications. Write for new literature that will give you the complete story on *Pre-Cast Bearing* BRONZE ON STEEL.

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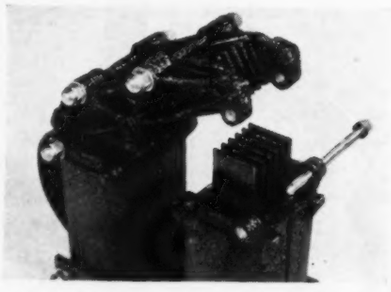
WHAT'S NEW IN EQUIPMENT

Split Core Current Transformer

One of the features claimed for Annis split core current transformers is that their accuracy is practically independent of the tightness of closing the magnetic core. The seperable core may be left open as much as ¼ inch from "closed" position, without appreciably affecting instrument readings. This feature permits the metering of both watt and ampere loads at sufficiently high accuracy for all general testing. Another feature is that transformers also operate instruments drawing heavy volt ampere loads such as recording ammeters and wattmeters.



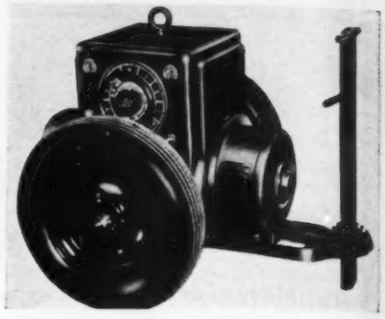
When the transformer is closed over a conductor, there is a choice of three primary current ranges, 150-300-600 amps. The secondary current being 5 amperes. If the conductor is looped, so it passes through the opening twice, the full scale primary current ranges are 75-150-300 amps. If the conductor is passed through three times, the primary current will be 50-100-150 amps. All three methods of connecting the transformer are equally accurate.

Transformers are compensated for a 10-volt ampere instrument burden. Other instrument burdens may be used with a slight reduction in accuracy. Other primary current ranges (up to 1,000 amps.) instrument burden compensation, as well as the furnishing of ratio and phase angle curves are available on special order.

Windings are tested at 2,500 volts to ground for one minute. Transformers may be used on circuits of any voltage providing the conductor is properly insulated before placing the transformer in position. R. B. Annis Co., Indianapolis, Ind.

Trailer Unit

Two-wheeled, lightweight, pneumatic-tired trailer for mounting 200, 300, 400 amp. Hobart electric drive welders, designed for road towing up to 35 miles per hour, is useful for hurry-up trips to different locations for emergency production, maintenance, and repair work. Mounting is accomplished by three bolts in frame of trailer which register with three holes in the legs of the welding machine. Combination two bar and standing support has a hand-operated ratchet for locking support arm in position. Unit is easily moved by hand by virtue of its low, underslung construction; narrow tread; and precision method of balancing. Trailer is capable of trailing over rough terrain. Measures 54 inches long, 45 inches wide, 27 inches high (over tires); 13 inches axle center. Tires are 16x5.50, 4-ply. Hobart Brothers Co., Troy, Ohio.



Blackout Paint

Known as Midland P-40, blackout paint has been made for outside application. Dries rapidly (30 to 40 minutes) to a self leveling, dull, flat surface that inhibits reflections or halations. Can be brushed on or thinned with proper solvent to spraying consistency. Paint is resistant to heat, unaffected by sun rays, summer heat, or high heat from inside buildings such as heat-treating plants, foundries, forges, boiler-rooms; rain, sleet, snow, or exhaust steam will have no effect on the dried paint film, according to the manufacturer.

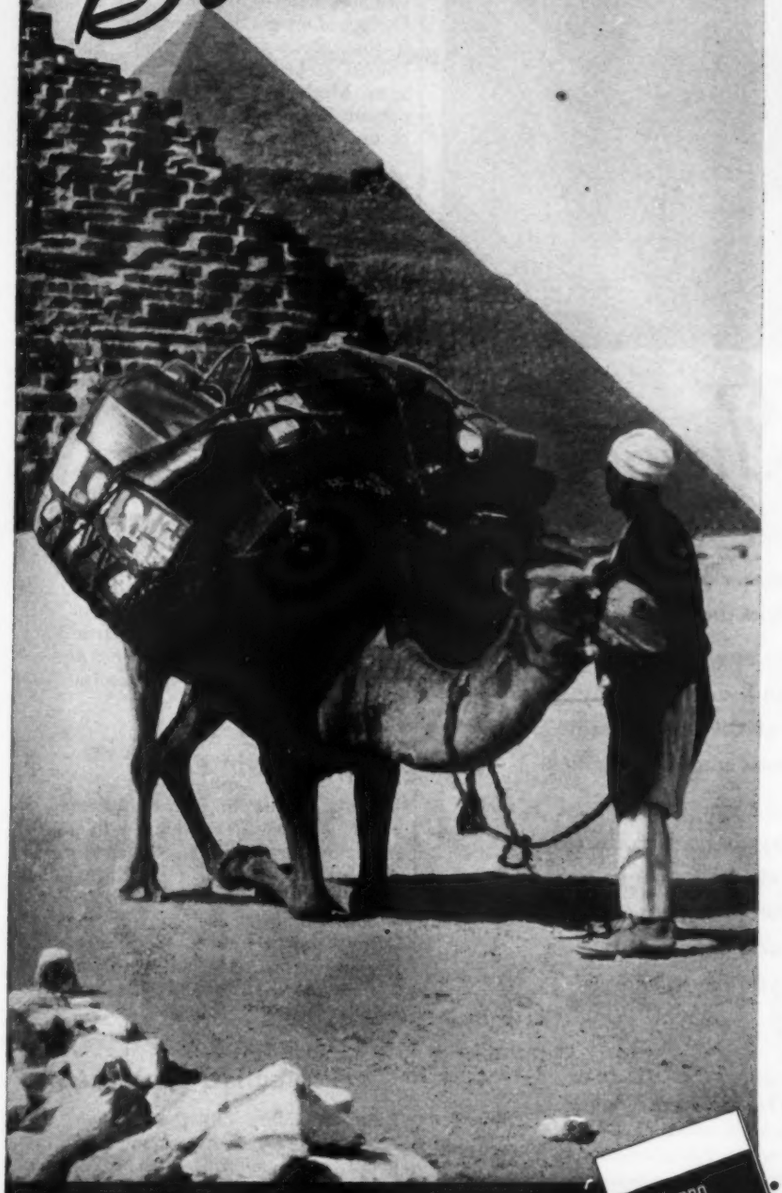
May be easily removed from glass windows simply by wiping off with solvent. The Midland Paint & Varnish Co., 9110 Reno Ave., Cleveland.

Industrial Brush

Used with the proper abrasives, Fascut Treated Tampico Section will remove tool marks from motor parts, such as connecting rods, tappets, cams, etc., it is claimed.

I NEED

Balance



AMERICAN ENGINEERING COMPANY

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LO-HED, the *Balanced* Hoist. You can instantly single out a Lo-Hed hoist because of its characteristically different appearance. Ordinarily, appearance isn't important in a hoist but it just so happens that a Lo-Hed hoist gets its appearance from a basically different construction. Motor and drum are arranged on opposite sides of the beam. The hook is directly in the center and can be pulled up close to the beam—an extra advantage where headroom is low. Because motor and drum shafts are separate and parallel the motor can be geared to the drum through efficient spur gears. Buy the hoist that's balanced if you want low operating and maintenance costs. Write for Lo-Hed catalog today.

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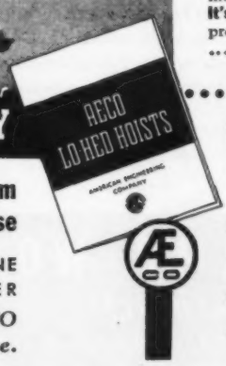
It Costs Less To Operate—All gears are efficient stub-tooth spur gears running in a sealed oil bath . . . gear shafts and trolley wheels are equipped with heavy-duty ball or roller bearings.

It Costs Less To Maintain—Sturdy construction . . . seldom, if ever, requires removal from rail . . . covers of controller, motor, drum and gearing are easily removed.

It's Safe—Factor of safety of over 5 at full capacity . . . 100% Positive Automatic Stop when load reaches upper limit . . . Automatic Holding Brake prevents load from drifting when current is shut off . . . short, strong shafts minimize torsional stresses.

It's Protected—Controller is fire, dust and moisture proof . . . motor totally enclosed . . . gearing sealed in . . . motor and drum covered by easily removable covers.



The Lo-Hed Hoist Is Applicable To Any Monorail System
There's A Balanced Lo-Hed Electric Hoist For Every Purpose

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Look in your Classified Telephone Directory under "A-E-CO LO-HED HOISTS" for your nearest representative.

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☐ Please send me your complete catalog of LO-HED HOISTS.
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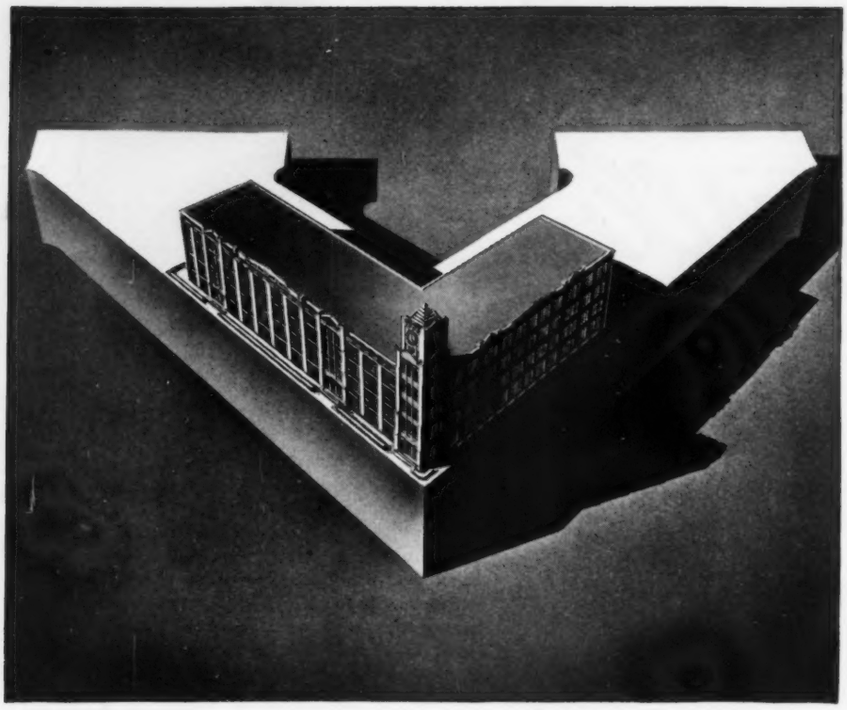
(Please print plainly)



WORKING FOR VICTORY

Good lamps and quantities of them are essential to the all-out production effort that will win the war.

Under this roof every worker, every engineer and every inspector guarding the quality and dependability of Champion Lamps, is concentrating on the task of turning out the very best lamps using the least amount of critical war materials.

If *our* efforts succeed in contributing to *your* production efforts we shall consider it a job well done. Get in touch with the nearest Champion distributor. See what he can do to meet your present need for good lamps at low cost. We'll gladly send you his name if you haven't it.

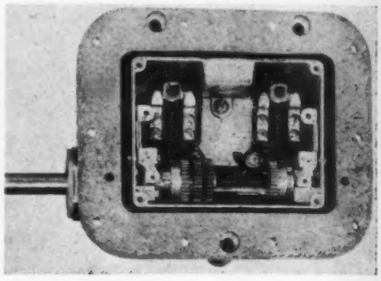
★ **Pictured above is the home of Champion Lamps—the headquarters of an organization that has devoted its skill, experience and resources since 1900 to the making of electric lamps of unsurpassed quality — licensed under General Electric Co. incandescent and fluorescent lamp patents.** ★

CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.

Another application of the section is the slight rounding of corners of different motor parts, gear teeth, and similar products. When used without abrasives brush will remove burrs without damage from metals such as aluminum and Alclad. Available in diameters of 4, 6, 8, 10, 12, 14, 15, and 16 inches. The Osborn Manufacturing Co., Cleveland.

Rotating Type Limit Switch

Two new forms have been added to line of CR9441-C2 rotating-type limit switches. One form is for Class 1, Group D, hazardous gas locations and the other is for water-tight applications. Both are housed in heavy, flanged, cast-iron inclosures. Mechanism of switch is adjusted to operate the contacts between a minimum of one-half turn of the driving shaft and



a maximum of 120 turns. Indefinite overtravel will not harm the switch mechanism. Double-break, fine-silver contacts clean themselves by opening and closing with a rocking motion. New contact tips can be installed with a screwdriver. One double-break contact is located at each end of the travel, and can be made normally closed or normally opened without additional parts. General Electric Co., Schenectady.

Lamp-Lock

Locking fluorescent lamps in their sockets by Flur-o-locks is claimed to prevent premature lamp failure, loosened lamps, accident hazards, lamp replacements. Simple to apply by placing one lock on the contact prongs at each end of the lamp, setting lamp in sockets, and inserting keys in socket slots. Available for 10- to 40-watt fluorescent lamps, single slot sockets. Laduby Co., New Haven, Conn.

Protective Lighting

Elipso Standlite fills the need for protective illumination around industrial plants, and conforms with FBI specifications. Due to its elliptical shape, the fixture provides a wide lateral distribution of light. With proper spacing of fixtures,

"THIS EFFORT REFLECTS PRECISELY WHAT WE WOULD HAVE EVERY INDUSTRIAL PLANT IN THE COUNTRY UNDERTAKE"

George T. Weymouth, Chief
Industrial Salvage Section
Bureau of Industrial Conservation

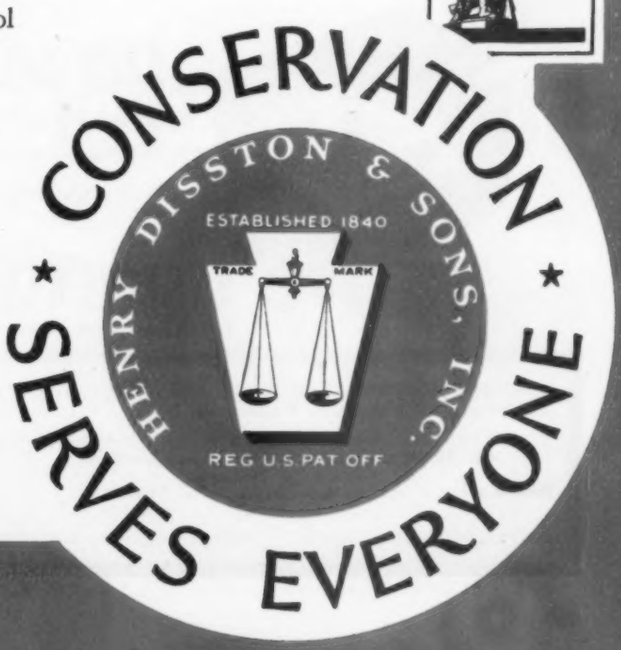
The Bureau of Industrial Conservation has approved the Disston Conservation Control Plan for the practical aid it brings industry in speeding war time production, in saving working time and in conserving vital tools and materials.

Disston will provide individual instruction cards for each of your employees who work with files, hack saw blades, tool bits, metal cutting and wood cutting circular saws, planer knives, veneer knives, paper knives and other tools. The cards contain concise, expert instruction on the proper use and the best care of the tool, as well as the correction of faults in operation. Their practical purpose is to conserve essential materials, reduce unproductive delays, and lengthen tool life—and by so doing, to accelerate and increase production, improve workmanship and better your products.

In addition Disston will send you, also without charge, Bulletin Board Posters and other promotion material for plant use—to encourage employee interest and participation.

Furthermore, you have at your command Disston Engineering Service. Wide experience qualifies Disston engineers to fit the most efficient tool to the job . . . help you meet the demands of emergency production . . . and aid you in your cooperation with the government.

Now is the time to enlist *your* plant in the national war on waste! Complete information will come to you at once following your inquiry. Write *today!* Henry Disston & Sons, Inc., 324 Tacony, Philadelphia, Pa., U. S. A.

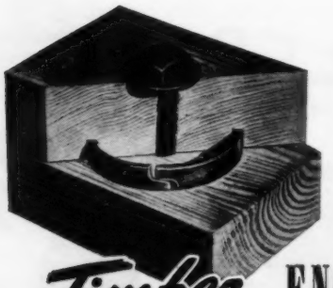


READY! There is no shortage of timber—immediate deliveries are certain.

RUSH! Prefabrication by the TECO Connector System of timber construction speeds the job and *gets the contract.*

REDUCES COST! The TECO Connector System cuts man-hours and material costs because fabricators deliver members ready to install—and permits lighter timber to do the work.

Get Complete Details—MAIL COUPON!



TECO CONNECTORS

spread the load on a timber joint more equally over the cross-section of the wood.

Timber ENGINEERING COMPANY

1337 Connecticut Avenue WASHINGTON, D. C.

TIMBER ENGINEERING COMPANY, INC. Dept. AG-3
1337 Connecticut Avenue, Washington, D. C.

Please send me without cost or obligation complete information on the TECO Connector System of construction.

Individual..... **Firm**.....

Street..... **City**..... **State**.....

a brilliant barrier of light is created around property lines without illuminating buildings and grounds. Watchmen remaining in the darkness, can instantly spot the entrance of any intruder into the brightly lighted fence or boundary area. With the low mounting height, lamps of from 300 to 500 watts deliver a high intensity of illumination.

Available in two styles, direct style, which delivers light laterally, and angle style, which provides a slight forward throw. Finished in permanent porcelain enamel, weatherproof, fixtures are easily installed and serviced. Designed for mounting on a standard 2-in. pipe. Goodrich Electric Co., 4600 Belle Plaine Ave., Chicago.

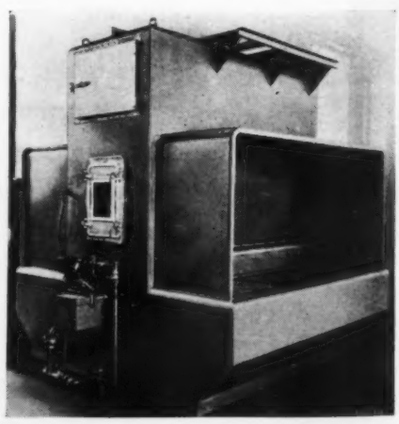
Blackout Ventilator

Vita-screen blackout ventilator is made of heavy-gage galvannealed steel sheets arranged in baffles to force the incoming air to turn two corners before it can enter the room. Painted black, ventilator is completely light-penetration proof, not even diffused light showing from the outside, yet at all times the baffles allow a free flow of air sufficient to ventilate a room. Between the baffles #16 mesh wire screening (also painted black) adds protection and aids in keeping out dust and dirt. Louvers are stormproof and installed as complete blinds, which may be opened or shut, either on the inside or the outside of factory sash. For pivot sash, installation is made half in and half out, to allow freedom of action of the sash itself.

Permanently installed by steelworkers or carpenters, according to whether the sash is steel or wood. Protects against flying glass when placed on the inside of windows. Practical, and can be installed quickly in doors, windows, shutter panels. Works with or without mechanical ventilating equipment. Vita Screen Ventilator Co., 103 Park Ave., New York.

Dust Collector

Hydro-Foam dust collector is a completely self-contained unit, providing both bench and hood, together with adequate dust collection and ventilation. Tank forming the base of the unit is filled with water. Side extension of tank forms the bench which has for its surface a wooden grillage.



Production . . .

Day and night BWH is producing mechanical rubber goods. Thru our distributors many of these products reach factories running largely on defense work — as well as army cantonments, naval stations and Government flying fields.

Because of national defense requirements our stock of mechanical rubber goods may not be as complete as in normal times. Faced with emergency demands, we naturally cannot replenish our stock as promptly as formerly.

We ask our customers to bear with us and to be confident that we are trying in every conceivable way to produce their requirements as rapidly as possible.

We naturally regret losing business as much as you do . . . because volume business means ideal operating conditions . . . and because we consider our customers as our most valuable assets.

Production battles are not won by factories or machines alone. They are won by morale . . . by the courage and spirit of both workers and management to get things done. Customers' morale helps, too.

BOSTON WOVEN HOSE AND RUBBER COMPANY

WORKS: CAMBRIDGE, MASS., U. S. A. ★ P. O. BOX 1071, BOSTON, MASS., U. S. A.

Keep YOUR PLANT OPERATING *while laying* *Carey Elastite* INDUSTRIAL FLOORING ★

This Modern, HEAVY-DUTY Flooring meets Demand for ALL-OUT Economical Production

To speed production—get rid of rough, dangerous, energy-wasting floors—surface them with CAREY ELASTITE Industrial Flooring. Lay it during week-ends; use it immediately. Prevent shutdowns; save time.

Smooth and resilient under foot, CAREY ELASTITE increases workers' efficiency. A printing concern found, that since application of this flooring, two men easily move a 4,000 lb. skid of paper which previously required four to five men for the job.

CAREY ELASTITE Industrial Flooring is TOUGH, long-wearing, non-skid, dustless; lessens accidents and breakage of trucks and tools. It is fire-resistant; practically noiseless under steel-wheel traffic. Its favorable first cost, long service and low maintenance, reduce floor overhead.

THE PHILIP CAREY MANUFACTURING CO.
Lockland, Cincinnati, Ohio
Dependable Products Since 1873
IN CANADA: THE PHILIP CAREY COMPANY, LTD.
Office and Factory: LENNOXVILLE, P. Q.

If you have a floor problem, don't experiment. Solve it with CAREY ELASTITE Industrial Flooring. Write today for folder giving full details. Address Dept. 31.

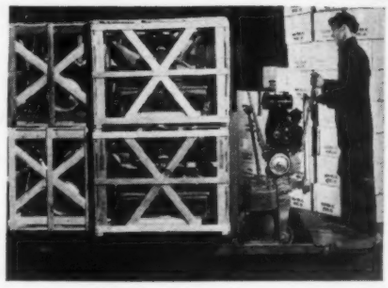
onto the surface of the water, directly underneath. Larger chips and coarser dust particles settle by gravity to the bottom of the tank. Air, still carrying dust, is forced downward against the water solution in the tank forcing the bulk of the remaining dust into the water. The impinging action of this operation aerates the water solution and creates a bed of spray in the chamber above the water tank. Only the finest dust particles remain in the air currents passing up and through this spray bed. The exhaust fan and motor are mounted on the top of the unit and discharge directly into the room through a diffuser head.

The only moving part in this Mahon Hydro-Filter Unit is the motor-driven fan, making for simplicity of operation. There are no pipes, pumps, or nozzles in the air stream.

Only one starter is necessary. Available in single or double unit. Entire unit is portable, and requires only electrical, water, and drain connections. The R. C. Mahon Company, Detroit, Mich.

Industrial Truck

Elevating platform truck known as the Truck-Man is designed for rapid movement of loads weighing 2,000 lb. or less. Truck alone weighs 800 pounds. That it is simple to operate, economical to maintain, and inexpensive in first cost, are

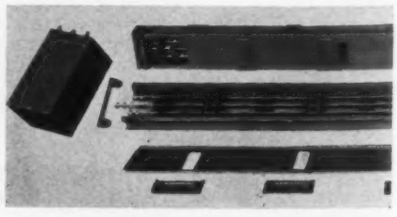


among the features claimed for the truck. Powered with 1½-hp. motor. Antifriction bearings throughout. Operates forward and reverse at same speed, turns in its own length. Yard-Man Inc., Jackson, Mich.

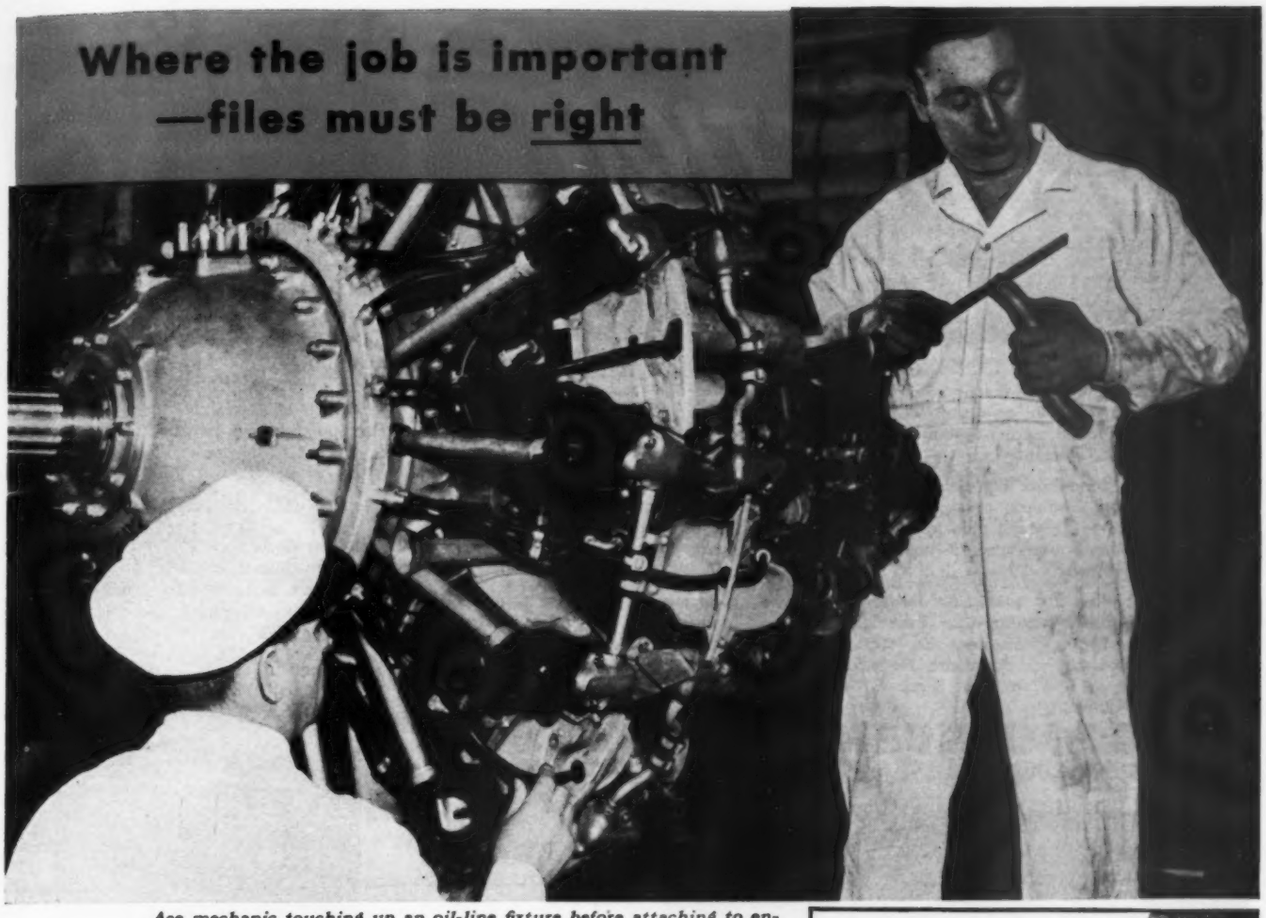
Bus Duct

Bus duct for industrial secondary power distribution systems is announced. Units are of the plug-in and feeder types. Composed of copper busses, Prestite separators, and a dust-tight metal inclosure, unit is available in ratings of from 250 through 1,500 amps. At currents below 1,500 amps., hot-rolled sheet steel is used; at values of 1,500 amps. or above, a feeder duct of different construction is available.

Plug-in sections are supplied in 10-ft.



Where the job is important —files must be right



Ace mechanic touching up an oil-line fixture before attaching to engine being inspected during overhaul job. Courtesy United Air Lines.

To carry assurance of Victory, America's war effort must be *efficient* as well as huge. In engine, aircraft, guns, shells and precision instruments, for example, not a single detail must be left to execution that is just "good enough." Only "the best job that can be done" gets the vigilant inspector's okeh.

Such high standards of workmanship—in *any* industry—demand the right tool, as well as the right man, for the job. In a file it means one that is *correct* in design and size for the kind of metal, shape or part on which it is used; for the amount of metal to be removed and the finish or precision to be attained.

In addition, it must be thoroughly *dependable*—of uniformly fine steel, uniform cut, uniform hardness . . . so that the hundredth file will render exactly the same performance as the first.

There is no better file-selecting guide than the recommendations of the largest manufacturer of quality files in the world—under the Nicholson guarantee of *Twelve perfect files in every dozen.*

Three Nicholson special-purpose files extensively used in war and other industries are shown and briefly described at the right. TECHNICAL BULLETINS on these, and also on files for Foundry Castings, Die Castings, Lead, Plastics; and for Die-making, Shear Tooth and Lathe filing, will gladly be mailed on request. Name ones desired. For your file needs, contact your mill-supply house.

NICHOLSON FILE CO. • PROVIDENCE, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

NICHOLSON FILES
FOR EVERY PURPOSE

NICHOLSON U.S.A. MADE IN U. S. A.

ALUMINUM TYPE "A" *FILE.* Special serrated-tooth and open-throat cut—to prevent clogging and "chatter." For rapid filing of aluminum and other ductile-metal castings, bars and sheets. In flat and half-round shapes, and full range of sizes.

BRASS FILE. In addition to a short upcut angle, the teeth of the Nicholson Brass File are made with a very fine and long-angle overcut. This produces small scallops which break up filings and enable file to clear itself of chips. Also prevents "grooving."

STAINLESS STEEL FILE. To combat the abrasive action of this steel's hard chromium carbides and nickel alloy, the Nicholson Stainless Steel File is made with teeth cut unlike that of any other file. It enables fast stock removal on thick-section work; smooth filing on thin sections.

Now PRODUCTION Doubled-Trebled

NEVER before in the history of this great country of ours has the demand on industry been so great. It is production—faster, faster, faster! And faster production means systematic production. All work must move along easily, quickly, and efficiently.

• American MonoRail Equipment increases and helps speed up production. It also reduces handling costs. It relieves men from lifting and carrying, and enables them to give full time to production. American MonoRail Equipment keeps materials and products on scheduled routes without congestion, delay, and damage in transit.

Standard parts are assembled into complete systems to meet the special requirements of the particular job. Supplied for manual, electric, or automatic operation. No job too small, none too large. No interruption to your production during installation. Let an American MonoRail Engineer show you how to "open the production throttle" in your plant.

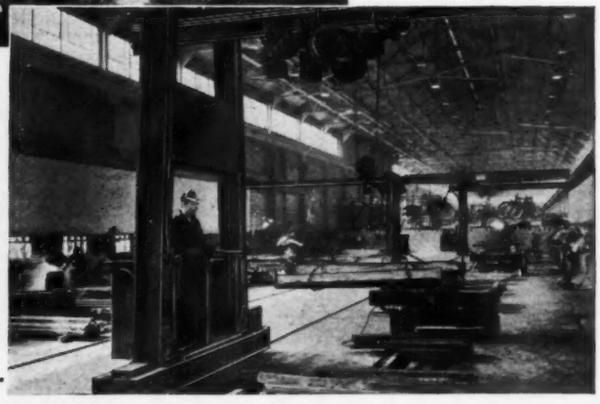
THE AMERICAN MONORAIL CO.
13114 ATHENS AVENUE CLEVELAND, OHIO

Free moving crane transfers heavy loads by easy hand operation.

•

Gantry moves billets to snaggers by power operation from central control.

WRITE FOR Blue Book illustrating hundreds of MonoRail installations.



IF YOU *Plan* TO BUILD OR EXPAND ★

The complete facilities of our engineering staff are at the disposal of any company—their architects or engineers—planning to expand or construct new buildings. Through long experience, we are able to cooperate effectively in planning right heights, proper sizes and placement of structural members, and in other ways which result in buildings being designed to fit the needs of the user. This service is yours for the asking.

line units with outlet service staggered every 12 inches along a run. Outlet receptacle covers are not removed but simply slide along duct to expose plug-in connections.

Heavy silver plating of contact areas at bus bar joints assures good contact. Insulators are of Prestite. Complete insulation of plug-in receptacles aids safety by preventing flash-over in making or breaking plug-in contacts.

To install, the bus duct is hung by narrow double-strap hangers either edgewise or flatwise, depending on availability of plug-in. Where suspension rods are used, fastening is made to any convenient overhead suspension point and an adjustable cantilever clamp slides along the duct to the point of alignment. Westinghouse Elec. & Mfg. Co., E. Pittsburgh.

Racks and Bins

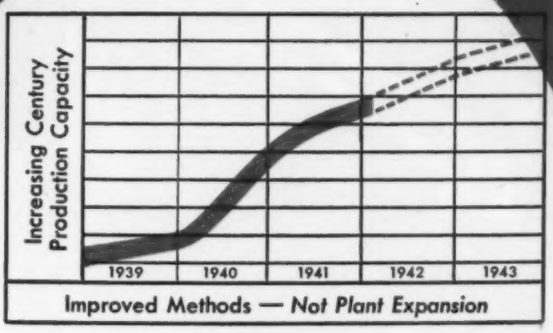
Racks and bins for small parts storage or assembly are designed in careful agreement with motion study principles so that parts are always visible and there is ample space for selection. Sloping bin bottoms provide gravity feed. Bin sizes provide

a volume scale of from 65 to 488 cu.in. With a simple adapter the 16 cu.in. bins will fit in the new racks. Used independently on the assembly bench, bins still retain tilted position. The Gordon L. Hall Co., Old Lyme, Conn.

Blackout Shades

No matter how many foot-candles illumination of the interior of any building, Andelco blackout shades over the windows and skylights will black it out, it is claimed. No light will be discernible and men and machines can go on with their work during blackouts. Shade has no horizontal battens or braces. Is retained in the vertical channels against wind and high explosive or bomb concussions by milled bronze balls clamped to the edges of the shades. Worm and worm wheel tension adjusters to permit easy adjustment of spring roller tension as well as thrust antifriction bearings to assure smooth easy operation, are provided as standard components. Box and channels are made of No. 20 gage electro galvanized steel. Standard finish is black wrinkle, in and out, or all-over. Cord is locked positively against H.E. concussion or other disturbance by eccentric cord lock

War Industries
Look to
CENTURY
MOTORS!



Thanks to more than two years of careful planning Century is meeting war production demands!

Since September of '39 Century has been planning its production facilities and methods to keep pace with the ever-increasing demand for the types and horsepower ratings of motors we knew would be needed for defense and war efforts — without plant expansion!

Wherever electric motor power is a factor in operating war machines — or in producing them — you'll find Century able to supply AC or DC Motors and Generators needed for the World War effort.

Call in your nearest Century Motor Specialist — you'll find him experienced and cooperative. He's working for Victory, too.

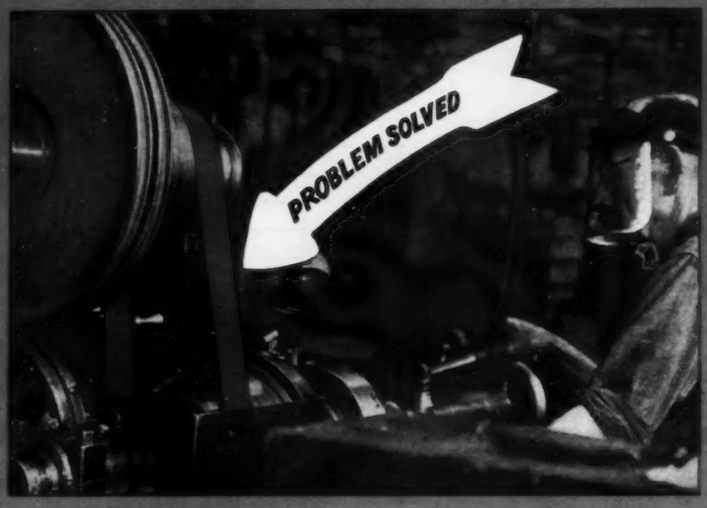
CENTURY ELECTRIC COMPANY
1806 Pine Street St. Louis, Missouri
Offices and stock points in principal cities

Century MOTORS

One of the Largest Exclusive Motor and Generator Manufacturers in the World.

★ ★ ★ A few of the Century Plants ★ ★ ★

GREATER HOURLY PRODUCTION
EVERY HOUR OF THE DAY—



without more machines!

If you are short on machines . . . Do this:

Survey your *drives* . . . Make sure your production schedule is not being slowed by slipping belts. Where that condition exists, remedy it at once; install Rhoads Tannate Watershed Leather Belts!

Tannate's exceptional grip assures *maximum power transmission* even at peak loads . . . keeps machines running smoothy at constant speed and at high rate. You get more uniform work, less spoilage, fewer shut-downs, reduced unit costs . . . *more efficient work* —as well as *more work* from existing equipment!

TANNATE'S great strength assures long service life, with little maintenance. Tannate is ½ to ⅓ stronger than most first quality oak leather. It has a higher overload capacity; stretches very little. Tannate is more resistant to heat, water, machine oils and some chemicals. Ask about Tannated Belts still, TRY IT!

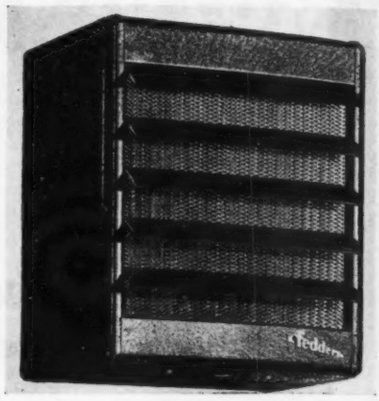
J. E. RHOADS & SONS
35 N. SIXTH STREET, PHILADELPHIA, PA.
NEW YORK • CHICAGO • ATLANTA • CLEVELAND

STEP UP PRODUCTION WITH
RHOADS
Established 1702
Tannate
WATERSHED
LEATHER BELTING

made of cold rolled steel and provided with a bronze pin axis. Andel & Co., Inc., 5218 N. Kedzie Ave., Chicago.

Unit Heaters

Performance characteristics of Series 4 Lo-Temp unit heaters include conditions of low final temperatures combined with large cfm and long-range heat distribution. Streamlined tubes and latest type, wide-



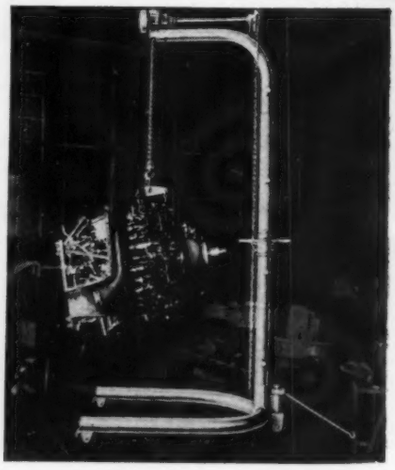
blade fans result in quiet operation. Units are designed to operate on steam pressures up to 150 lb., with emphasis on low final temperature. Built in 12 capacities ranging from 75 edr to 1,200 edr. Air Conditioning Division, Fedders Manufacturing Co., Inc., Buffalo.

Floodlight

For outside service, floodlight No. 3500 has reflector of heavy gage spun steel, finished to highly polished reflecting surface. Clear convex heat-resisting lens, attached by detachable ring which has a lever action clamp. Heavy adjustable triple-purpose bracket for mounting, which may be used for wall, crossarm, or pipe. Can be mounted on any size pipe up to 2½ inches. Steber Manufacturing Co., 2451-7 N. Sacramento Ave., Chicago.

Hoist

Portable hoist features streamlined design, elimination of all unnecessary superstructure, and ease of handling. Known as the Aero hoist it has a single upright mast



Study of Fastening Methods May Conserve Man-power, Lower Unit Costs

More attention paid to fastening methods, and the testing of present methods against possible improvements, often result in savings which amply repay both the time spent in research and the cost of new, more efficient equipment.

Factors ordinarily observed, in making a "fastening-analysis" of assembly line efficiency, include time-and-motion recordings, worker fatigue, possibility of substituting automatic machine methods, as well as the physical tests of the fastening itself, such as tests for resistance to vibration, pull-out, shear, etc., varying with the particular fastening problem.

Solutions of fastening problems may be very simple — such as the substitution of Bostitch stapling hammers instead of ordinary hammers and tacks, a change which has saved as much as 45% of assembly costs in certain upholstering and covering operations.

In other cases, such as in the fastening of metals to metals, or to other materials, the application of the steel-stitching or stapling method may eliminate certain operations entirely. For instance . . .

Bostitch Steel-Stitcher Saves $6,250 per Year in Assembly of Vacuum Cleaners

Formerly this manufacturer, attaching disc flanges to metal cylinders, had to punch holes before riveting. A Bostitch steel-stitcher, with a Bostitch-engineered attachment for stitching on the *inside* of the cylinder, now makes punching unnecessary. Savings in cost per unit will total $6,250 a year.

Other manufacturers have effected similar savings . . . one of them saving ⅔ of labor costs with a $100 machine . . . another getting back the cost of 5 machines in only 10 days! For further information and case studies applicable to your industry — particularly if you are now engaged on defense orders — write to BOSTITCH, 62 Blackmore Street, East Greenwich, R. I.

Here's a new and larger Bostitch Self-feeding Hammer (Model H-3), driving a heavier ¾-inch staple — *one hand, one blow* — as fast as you can flick your wrist. *At present exclusively allotted for defense needs* . . . for other work when these have been met.

★ ★

HAMMERING FOR PRODUCTION, TOO

MODEL B8-H BOSTITCH HAMMER
Tack Hammer Size

Another new and smaller Bostitch Self-feeding Hammer! Drives light ¼-inch staples . . . lightning fast . . . for labelling, posting, decorating. Adds ten inches to your stapling reach.

MODEL H-2 BOSTITCH HAMMER
The Ten-Year Tested Hammer

Proved by thousands of users . . . on thousands of different applications . . . without an equal on countless types of work. Self-feeding. On defense work, right now . . . speeding up hundreds of important jobs.

FOR ANY FASTENING JOB

To replace sewing, gluing, tacking, riveting, spot welding

★ ★ ★ ★ ★ ★ ★

"BOSTITCHING" means: the right stapling, tacking, or wire stitching machine out of nearly 800 models . . . and the right staple or wire . . . to get you the right results most efficiently and economically. These three Bostitch Hammers represent twenty years of experimental work, are examples of Bostitch Engineering that is always available to help you solve your fastening problems. Forty years of experience, plus a trained field organization of 350 men specializing in this work, are helping modern industry to *"fasten it better with wire."*

BOSTITCH
fastens it better with wire
STAPLING · STITCHING · TACKING

MAKE YOUR PLANS *NOW*

Bostitch equipment available for any defense work . . . some for civilian needs. Information for immediate or future application promptly furnished. Send samples of work to be fastened. Bostitch, 62 Blackmore St., East Greenwich, R. I.

One OF 300
Types and Sizes of
DUFF-NORTON
JACKS

No. 514-M
THE DUFF-NORTON MFG. CO. PITTSBURG PA. U.S.A.
514M
DUFF-NORTON JACKS
CUT COSTS SAVE TIME
Easy operation, dependability, speed and economy have been engineered into the design of every Duff-Norton Jack. Specify Duff-Norton if you want the best!
THE HOUSE THAT JACKS BUILT

THE DUFF-NORTON MANUFACTURING CO.
PITTSBURGH, PENNSYLVANIA
Canadian Plant:
COATICOOK, QUEBEC
Representatives
in Principal Cities

equipped with riser steps and adjustable platform. A chain hoist raises and lowers the work or supports it at any desired height, and an extension keeps the hand chain safely away from the load. A brake locks the hoist in position. Available in 1- and 2-ton models. Aviation Department, Whiting Corp. Harvey, Ill.

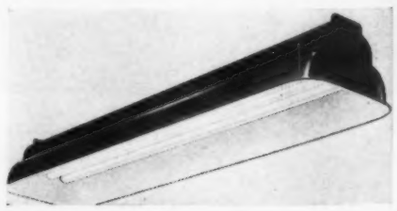
Photo Electric Control

Scanner consists of a light source and two photo-tubes in a single, compact housing, ready for attachment to any sensitive photo-electric amplifying system. Used wherever photo-electric control is desired from a re-

flecting surface two inches or less from the unit. In operation, light from the bulb mounted in metal housing passes through the double converging lens in lens barrel, then through aperture. A highly concentrated spot of light strikes the surface being scanned and is reflected back into the photo-tubes, its intensity being dependent upon the reflective quality of the scanned material. Thus, a registration mark on moving paper, or the travel of a meter pointer into the spot of light concentration will cause a change in the illumination reaching photo-tubes. Response of photo-tubes to change in reflected light intensity is transmitted through coaxial cable to remote amplifier, making possible the control of auxiliary electrical devices. Measures 2¼x2¼x¼ in. and casing 3½x2¼x2¼ in. allows mounting in restricted spaces. Lens systems requires no adjustments. United Cinephone Corp., Torrington, Conn.

Fluorescent Unit

The Victory, a fluorescent industrial fixture features a porcelain enamel reflector of one-piece, seamless, non-welded construction; 13½ degree cut-off eliminates glare from all normal viewing angles. Made of heavy gage vitreous steel, with



triple-coated vitreous porcelain enamel reflector. Easy to maintain and service because reflector is quickly detachable from housing. Power factor corrected. Latest approved ballasts and starters. Two

Scully Service

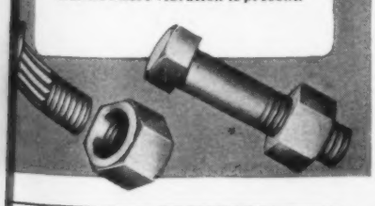
Structural material
Plates, various qualities
Floor Plates
Sheets: Hot Rolled, Cold Rolled, Galvanized, etc.
Bars (all shapes): Hot Rolled, Carbon and Alloy grades
Hot Rolled Strip Steel
Spring Steel · Tool Steel
Drill Rod
Cold Finished Bars, Carbon and Alloy grades
Wire
COR-TEN and MAN-TEN Shapes, Sheets and Plates
Abrasion-Resisting Sheets and Plates
Eaves Trough, Conductor Pipe
U·S·S Stainless Steel and Stainless products
Expanded Metal
Rails
Boiler Tubes
Rivets, Bolts, Nuts, Washers
Dardelet Rivet and Machine Bolts
Nails
Welders and Welding Accessories
Chain
Clamps
Flanges
Expanders, etc.
Hoists, Shears, Rolls, Punches, Cut-Off Machines, Saws, Nibblers, etc.

In Stock! Dardelet Bolts

We can offer immediate shipment of both Dardelet Rivet Bolts and Dardelet Machine Bolts. These bolts save valuable time and labor and assure permanently tight bolts.

The Dardelet Rivet Bolt is a ribbed bolt with Dardelet self-locking thread, and is widely used for field erection of structural steel. Has recessed nut. Bolt is driven in and nut is applied with wrench. Economical and strong.

The Machine Bolt with Dardelet self-locking thread is for general use where vibration is present.



Don't give up without calling Scully!

CHICAGO	**BRUnswick 2000**
Teletype CG. 605	
BALTIMORE	**GIlmore 3100**
Teletype BA. 63	
BOSTON	**STAdium 9400**
CLEVELAND	**HEnderson 5750**
Teletype CV. 153	
PITTSBURGH	**CEdar 7780**
Teletype PG. 475	
ST. LOUIS	**MAin 5235**
MINNEAPOLIS - ST. PAUL	**NEstor 2821**
NEWARK, N. J.	**BIgelow 3-5920**
	BErgen 3-1614 - REctor 2-6560

STEELS THAT MEET THE CHALLENGE OF TODAY AND TOMORROW

USS

SCULLY STEEL PRODUCTS COMPANY

Distributors of Steel and Steel Products

UNITED STATES STEEL

It's the Zip-Lift — neatest, smoothest little load-lifter in the business! This is no glorified chain block, but a true electric hoist with non-spinning wire rope and full magnetic push-button control. It's built for 3 types of interchangeable mountings — for hook, bolt, or trolley suspension. It'll cut your costs with "thru-the-air" handling wherever loads must move quickly, efficiently, and dependably.

It's surprising how far your hoist dollar goes with the long life Zip-Lift. And remember, honest delivery promises are P&H by-words. Call your nearest P&H representative or write us direct.

P&H Electric Hoists are available in all capacities up to 15 tons.

P&H
ZIP-LIFT
HARNISCHFEGER CORP. MILWAUKEE, WIS.

CAPACITIES: 250, 500, 1,000 lbs.

General Offices: 4525 West National Avenue, Milwaukee, Wisconsin

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CORPORATION
HOISTS • WELDING ELECTRODES • MOTORS P&H EXCAVATORS • ELECTRIC CRANES • ARC WELDERS

model, No. 2034, using 2 40-watt fluorescent bulbs, and Model No. 2035, using 3 40-watt bulbs. Both are high intensity, high efficiency units; 110-125 volts, a.c., 60 cycle. Also available for 50-cycle operation, or for 220-250 volts. Both units are Fleur-o-Liers and also are approved by Underwriters' Laboratories. Mitchell Manufacturing Co., 2525 Clybourn Ave., Chicago.

Tool Cabinets

Handy work bench-cabinet which features security and all-around usefulness is offered. Heavy gage working surface is suitable for small vises and grinders. In-

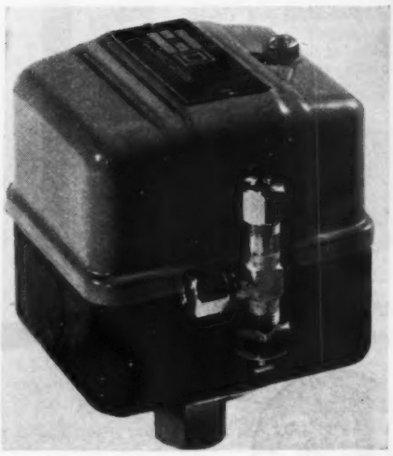
closed storage area, 12 ft. square, is protected by full swinging latch doors equipped with padlock hasp on 1½-in. centers. Finished in durable Lyon Green baked enamel. Lyon Metal Products, Inc., 3 Clark St., Aurora, Ill.

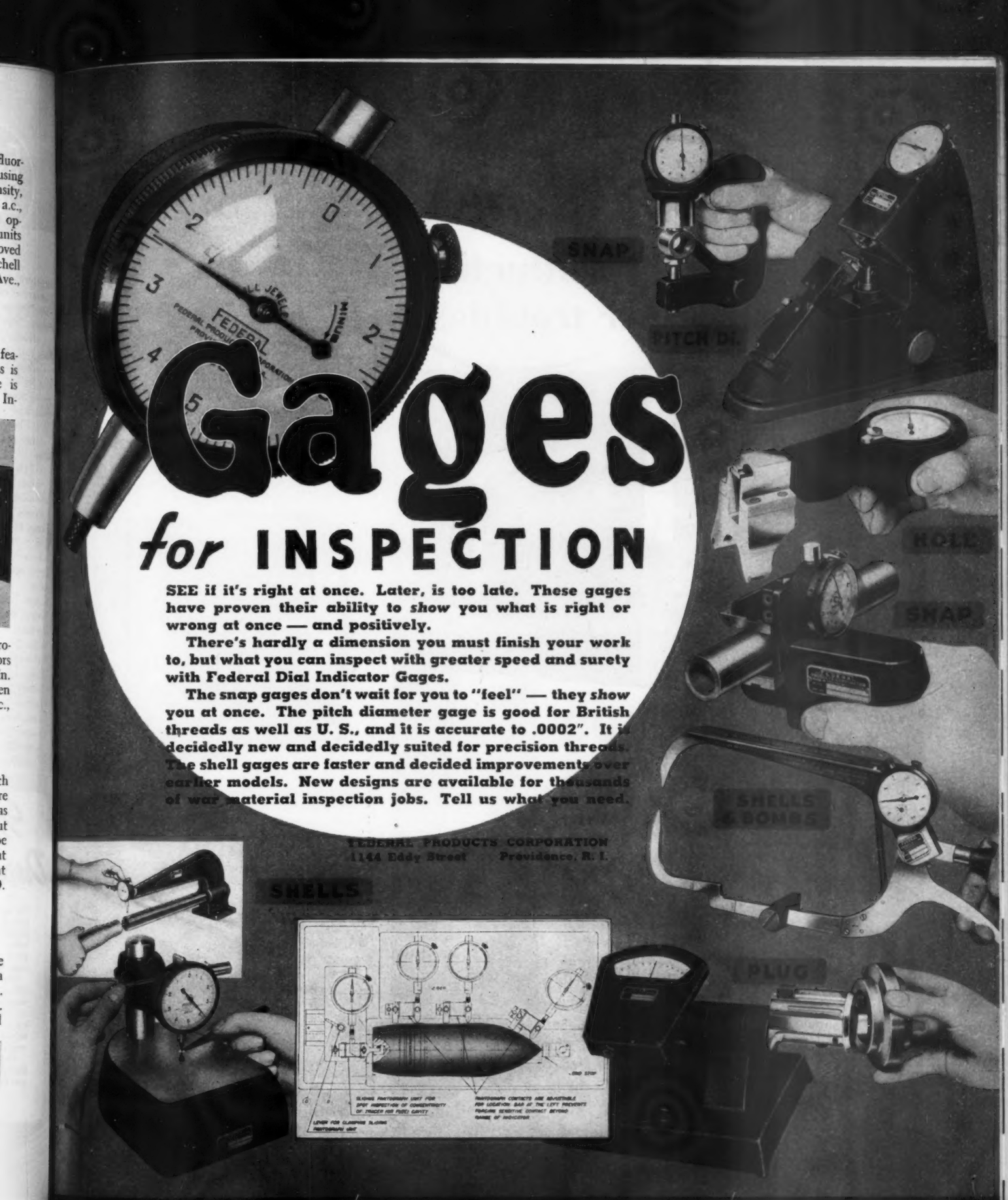
Blackout Paint

A black paint of complete opacity with weather-resisting qualities and the feature of overnight drying is introduced as Thompson's SP 3000 Eclipse blackout paint. Comes ready to use, and can be applied by brush or spray. Is a dead flat black that blocks the passage of light through windows. Thompson & Co., P. O. Box 6757, Pittsburgh.

Pressure Switch

The 9213 pressure switches are two-pole devices, especially designed for use with intermediate size air-compressor motors. Terminal block is made of strong porcelain. Terminal screws are plainly marked and





Gages *for* INSPECTION

SEE if it's right at once. Later, is too late. These gages have proven their ability to *show* you what is right or wrong at once — and positively.

There's hardly a dimension you must finish your work to, but what you can inspect with greater speed and surety with Federal Dial Indicator Gages.

The snap gages don't wait for you to "feel" — they *show* you at once. The pitch diameter gage is good for British threads as well as U. S., and it is accurate to .0002". It is decidedly new and decidedly suited for precision threads. The shell gages are faster and decided improvements over earlier models. New designs are available for thousands of war material inspection jobs. Tell us what you need.

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are in an upright position for quick wiring. Contacts are generous in size. Inspection of contacts is accomplished without removal of screws. Operating mechanism is simplified. No delicate springs or adjustments are incorporated. Actuating diaphragm is a high-grade fabric impregnated with a special rubber. An oil-resisting diaphragm can be supplied. Interior parts are cadmium plated to prevent corrosion. Range and differential can be easily changed in the field to meet varying conditions; 200 lb. pressure limit, 15 to 40 lb. differential. Square D Co., 6060 Rivard St., Detroit.

Tool Stand

Purpose of a recently developed tool stand is to keep tools right on the job. Each of the three drawers locks separately, a single drawer for each shift, which makes each man responsible for his own tools. Designed for heavy-duty service with all-welded steel

construction, 12-gage steel shelves, and heavy angle legs. Drawers are 18 inches wide, 16 inches deep, and 5 inches high. Overall size of each unit is 30 inches wide, 18 inches deep and 32 inches high. Penn Metal Corporation of Penna., 36 Oregon Ave., Philadelphia.

Blackout Glue

After painting window panes with black paint No. 222 Blackout Glue can be applied with a brush or sprayed, and gives a permanent waterproof bond for waterproof paper, cardboard, or fiber. In this way the glue will also act as a shatterproofing agent in the event of bombings. Midland Glue Products Co., 1488 Madison Ave., Detroit.

Insulation Resistance Tester

Weston Model 792 insulation and cable covering resistance tester is a compact device designed to adapt the Weston Model 785 industrial circuit tester or the model 772 test analyzer for the measurement of insulation resistance up to 900 megohms. Fits into the compartment of the Model 785 circuit tester, and operates from a 100–130 a.c. 50–60 cycle supply line. It is connected into the ohmeter circuit of the Models 785 or 772 by a pair of leads, and the insulation resistance measurement

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Right now rust can be working on the delicate governor mechanisms of your turbines . . . then without warning—trouble! To help prevent costly shut-downs and overhauls change over your turbines to *new* Shell Turbo Oil—it can prevent rust! The first turbine oil to meet all 3 vital requirements of modern turbine lubrication, it offers
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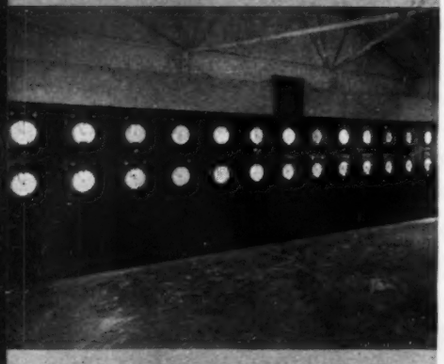
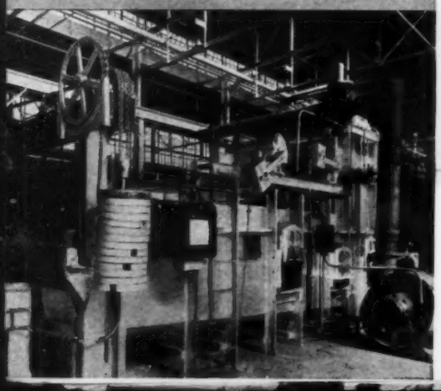
can maintain vital schedules!

Foxboro Temperature, Pressure and Flow Instruments give completely automatic control in airplane gasoline plants.



After simple initial setting, Foxboro Potentiometer Control Instruments hold heat *right* for forging furnaces.



HERE'S how more and more producers of vital war supplies are answering America's call for faster deliveries in spite of growing shortages in trained man power. At every critical production step involving temperature, pressure, humidity or fluid flow, they supplement their human operators with automatic Foxboro Measurement and Control Instruments that eliminate guess-work!

Thus, through simple installations, even highly exacting processes are now adapted to speedy, accurate handling by "green hands" with little training. "Old hands", too, can work with greater assurance . . . overall production is smoothly stepped-up to meet previously impossible delivery schedules!

Whether your production operations will be best served by instruments to record, indicate or control your processing conditions, Foxboro can supply the type you need and recommend installations to produce maximum results. Write for specific suggestions on the possibilities in your plant. **The Foxboro Company, 24 Neponset Avenue, Foxboro, Massachusetts, U. S. A.**

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MEASUREMENT AND CONTROL SYSTEMS

read on the ohmeter scale. Measurements up to a value of 900 megohms are made at a test potential of 500 volts as recommended by the AIEE, thus making it possible to determine whether insulation properties are above the safe working minimums. Weston Electrical Instrument Corp,. Newark, N. J.

Blackout Compound

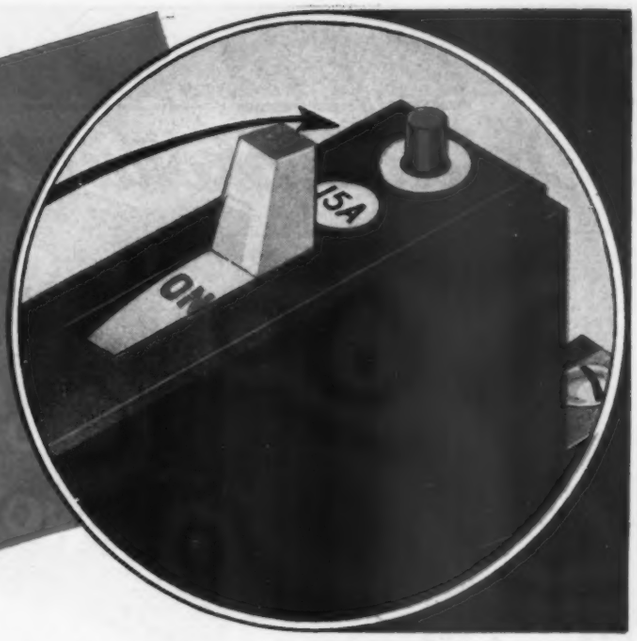
Blackout Compound No. 565 is a heavy bodied adhesive compound that can be readily sprayed or brushed and, when used in combination with fabrics, cheesecloth, burlap, or wire screen, eliminates flying glass particles even though the window is completely shattered. The fabrics require no additional adhesive. Compound is non-toxic, impervious to all weather, acid, or salt conditions, and not only blacks out interior light when sprayed or brushed on glass, but gives the desired exterior finish. May be applied alone or in combination with other materials. J. W. Mortell Co., Kankakee, Ill.

Pressure Gages

Complete line of extra-rugged pressure gages is now available for use wherever extreme mechanical vibrations, pressure pulsations and overloads, corrosive agents, dust, and gases are encountered. Especially designed and engineered for accuracy and long uninterrupted service under the toughest operating conditions.

Unaffected by severe mechanical vibration. Extra-large movement bearing surfaces are used throughout the mechanism

When tripped— red button protrudes



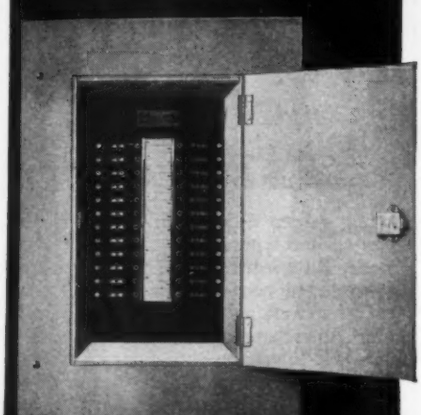
You can see at a glance which circuit has been affected. Even in the dark you can ascertain where the trouble lies — the projecting button tells the story . . . This is but one of the many features which have gained favor for

Dublbrak Circuit Breaker PANELBOARDS

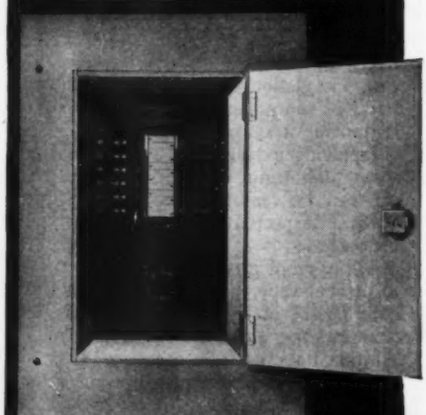
Protection against harmful overloads is assured — and, due to proper time lag characteristics, annoying interruptions of service, from short circuit or momentary overloads, are prevented.

- ★ There are only two positions of the handle — ON and OFF. *There is no intermediate position.*
- ★ Contacts are double-break, to provide low arcing . . . quick make and quick break for manual action, and quick break on automatic operation from sustained overload or short circuit.
- ★ Main bus bars are made of 98% pure hard-drawn copper, and direct copper-to-copper contact is made to circuit breakers.
- ★ The binding screws cannot be removed. Corrugations in the neutral connection plate prevent wires from turning when the screws are tightened.
- ★ Each (FA) Dublbrak Circuit Breaker is equipped with (FA) wire terminal connectors of the clamp contact type. The wire is inserted into a flared opening, and fastening screw tightened. *No washers or other parts are needed.*
- ★ Boxes are of code thickness steel, with knockouts to meet every requirement . . . 4-inch gutters make connecting easy.
- ★ Fronts are bonderized to prevent rusting, then finished in pearl gray lacquer. They are equipped with (FA) front fastening device, for ease in centering and plumbing.
- ★ Panelboards from 2 to 42 circuits are assembled from *standardized units.*

Capacities: 15, 20, 25, 35 and 50 amperes, 125 volts, single pole; or 250 volts, double pole, individual trip, AC or DC.



(FA) Dublbrak Circuit Breaker Panelboard and Cabinet, with main lugs only. (Catalog No. NA1B24-3L100).



(FA) Dublbrak Circuit Breaker Panelboard and Cabinet, with main breaker. (Catalog No. NA1B12-3AB100).

Let us suggest—"Ask the (FA) Man!"

(FA) Sales-Engineers are located in many principal cities. More than likely their long experience can be of real service to you. They welcome the opportunity to serve Architects, Engineers and Contractors. Write for name and address of the one nearest you — or see listing in Sweet's Catalog, Electrical Buyers' Reference or Thomas' Register . . . And ask us for Bulletin 57 . . . Frank Adam Electric Company, St. Louis, Mo.

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An urgent need in Defense production

Hot foods Hot soup Hot coffee for workers

Here's the low-cost way to provide them

Showing 5 food-pan assembly in vacuum-insulated carrier.

4 standard sizes.

AerVoiD portable vacuum insulated food, soup and... coffee carriers

Vacuum-insulated soup and coffee carriers.

6 standard sizes.

After all, Defense Production narrows down to keeping man-power on the job!

To that end factory managements are beginning to concern themselves with hot foods and beverages for workers . . . something more energizing than "cold lunches" to keep workers fit and to offset production-lag. They realize that both good will and good work are enhanced by hot foods for workers.

for servicing anywhere about the plant, indoors or outdoors

AerVoiD vacuum-insulated food, soup and coffee carriers step into this picture and do a job no other equipment can do. Hot foods and beverages can be kept hot for hours in AerVoiD vacuum insulated carriers, even though transported miles in outdoor cold-weather temperatures. No installation, low first cost, practically no operating cost, affording "throughout the plant" service, one building or 20 acres of buildings. Nearly 100 Defense Plants already use AerVoiDs to supplement cafeterias, to service hot foods without cafeteria set-ups. Write today for illustrated literature.

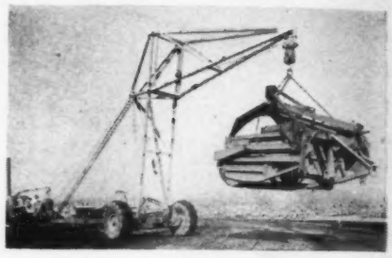
VACUUM CAN CO.
25 S. Hoyne Ave., Chicago, Ill.

AerVoiDs...keeping American man-power on the job

to overcome the vibration problem, and each screw in the gage is held in place with a lock washer. Light aluminum alloy case eliminates unnecessary weight, further reducing vibration troubles. Violent pressure pulsations are controlled by a patented adjustable damping device (not a needle valve) which is made a part of the instrument. This device enables accurate mean pressure readings to be obtained easily, yet does not affect instant gage response to pressure changes. Available in 350, 1,000, 3,000, 5,000 and 6,000 lb. ranges. Martin Decker Corp., Long Beach, Calif.

Cranes

Two cranes, L20 and L40, have been developed for handling bulky materials. These cranes give 20,000-lb. lifting capacity a horizontal distance of 20 ft. 6 in. out from axle center in upright position. Available in 20- and 40-ft. boom lengths operated from any size tractor or Tournapull with a LeTourneau double-drum power control unit, they offer large crane



lifting power with tractor mobility. All-welded box-type construction of special steels. Rubber-tired to permit travel over concrete surfaces and give ample flotation for working in soft, mucky conditions. Interchangeable with other LeTourneau equipment on the same power unit. Easily connected or disconnected in a few minutes, thus freeing tractor for other use when lifting jobs are finished. May be towed behind trucks for transporting from job to job. R. G. LeTourneau, Inc., Peoria, Ill.

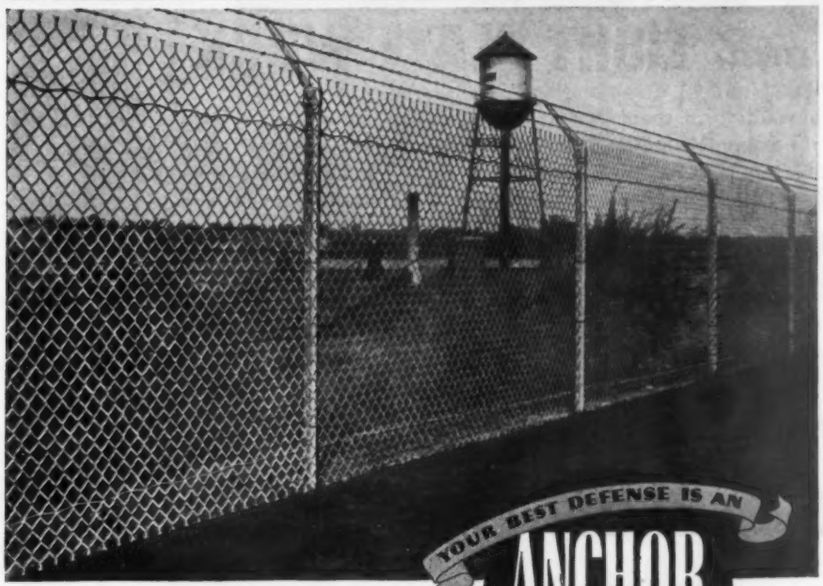
Mixing Chamber

Evertite chamber is designed especially for easy installation on modern oil storage tanks of the pressure type. Its purpose is to provide a simple yet effective method of applying a blanket of fire-smoothering foam to burning oil surfaces. Inspection cap can be removed, and a sealing diaphragm inspected without releasing tank pressure.

Vapor-proof glass diaphragm is installed to prevent vapors in oil storage tanks from entering the body of the mixing chamber, from entering and condensing in chemical solution lines, or from escaping to the air when bottom or top plate, or inspection cap, are removed. The diaphragm, glazed in a metal frame, holds gas tank pressure, yet ruptures fully under foam pressure at times of fire, allowing free access of foam blanket to burning surface. Diaphragms are readily replaced.

Chamber is of expansion type design, with increasing cross-sectional area to ensure intimate mixing of chemical solutions,

THIS "ALL-OUT" BARRIER says KEEP OUT in Any Language!



ANCHOR FENCE Keeps Out Saboteurs, Trouble-Makers

HERE'S one way to keep alien agents from throwing monkey wrenches into the machinery of defense. Install an Anchor Fence around your plant—and special Anchor enclosures *within* your plant to bar unwanted snoopers and saboteurs from your power stations, transformers, laboratories, chemical and material stocks, fuel supplies and other vital points.

Anchor Fences can be quickly erected in any soil, in any weather, even when the ground is frozen. The exclusive, patented, driven "Anchors" hold the fence erect and in line, resist terrific force, yet can be moved without loss in case of plant expansion.

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efficient formation of foam, and low velocity delivery. "A" and "B" solution inlets at bottom of chamber impinge within a baffle, assuring a thorough mixing. A small hole in bottom plate allows air to circulate within chamber, retarding corrosion; provides drainage; acts as tell-tale upon foam discharge. American-La France Foamite Corp., Elmira, N. Y.

Blackout Materials

To prevent reflected light from revealing a target, blackout coating which is said to be non-reflective and to insure complete light stoppage with one coat is announced. This coating is applied as a paint and is recommended for either inside or outside application, but is particularly desirable for preventing light reflection on the outside surface of skylights.

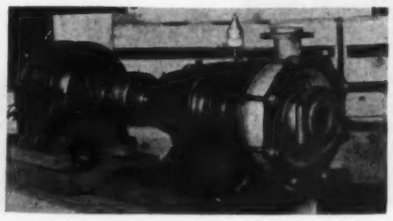
As a protection from flying glass, blackout boards of laminated asphaltic composition, cut to window size, are recommended by the manufacturer for application to the inside of windows. They are of good rigidity; moisture and condensation proof; easily installed and quickly removable.

To meet the demand for a more permanent, weatherproof, exterior blackout treatment is a laminated system, consisting of the application of a thick film of asphaltic coating, in which is embedded an asphaltic-saturated fabric membrane, topping this with a finish of the asphaltic coating. This treatment, it is asserted, effects a complete blackout and renders the glass shatterproof.

For quick temporary repairs to the blackout there is a tough, blackout paper. Smooth roll roofing or asphalt-saturated building paper can be used for emergency repair purposes. The Philip Carey Mfg. Co., Lockland, Cleveland, Ohio.

Convertible Acid Pump

Series of corrosion-resisting pumps in which it is possible to get 480 combinations of alloys, types, and sizes with heads



and capacities to meet practically any requirements have a special convertible feature. Durcopumps, made in high-silicon irons, can be converted to stainless steel pumps simply by substituting only the wet-end parts. Exchange can be made without disturbing setting of the pump. This convertible feature is said to be especially valuable where there are to be changes in the liquids handled. For instance, a pump for unloading acid tank cars can be converted to stainless steel to pump caustics. Other features include interchangeability of open and closed impellers with negative pressure on the stuffing box; oversize anti-friction bearings throughout; and micro-adjustment of the impeller. The Duriron Company, Inc., Dayton, Ohio.

Siren for Air Raid Alarm

Air raid siren, audible for miles, has a rising sound pitch or howl that reaches its maximum tone in from three to five seconds. Well adapted for signaling be-

cause of a sharp sound cut-off. Operates on steam or air at 50-to 250-lb. pressure, 425 deg. Fahrenheit total temperature. Foster Engineering Co., 109 Monroe St., Newark.

Steel Machinery Guards

Supplanting iron and aluminum castings, fabricated sheet steel machinery guards are coming into more general use in the machine tool industry under the impetus of war demands. Typical are those produced by the Bargar Sheet Metal Company, a

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BEFORE YOUR
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Wartime America has the greatest production control job ever attempted... a job for which Toledo Scales are vital! Whether it's a small scale for fractions of an ounce or the BIGGEST heavy-duty steel mill types or truck scales, built-in platform scales, hopper and tank scales . . . dial, beam or weight-printing scales . . . Look to Toledo for the answer!

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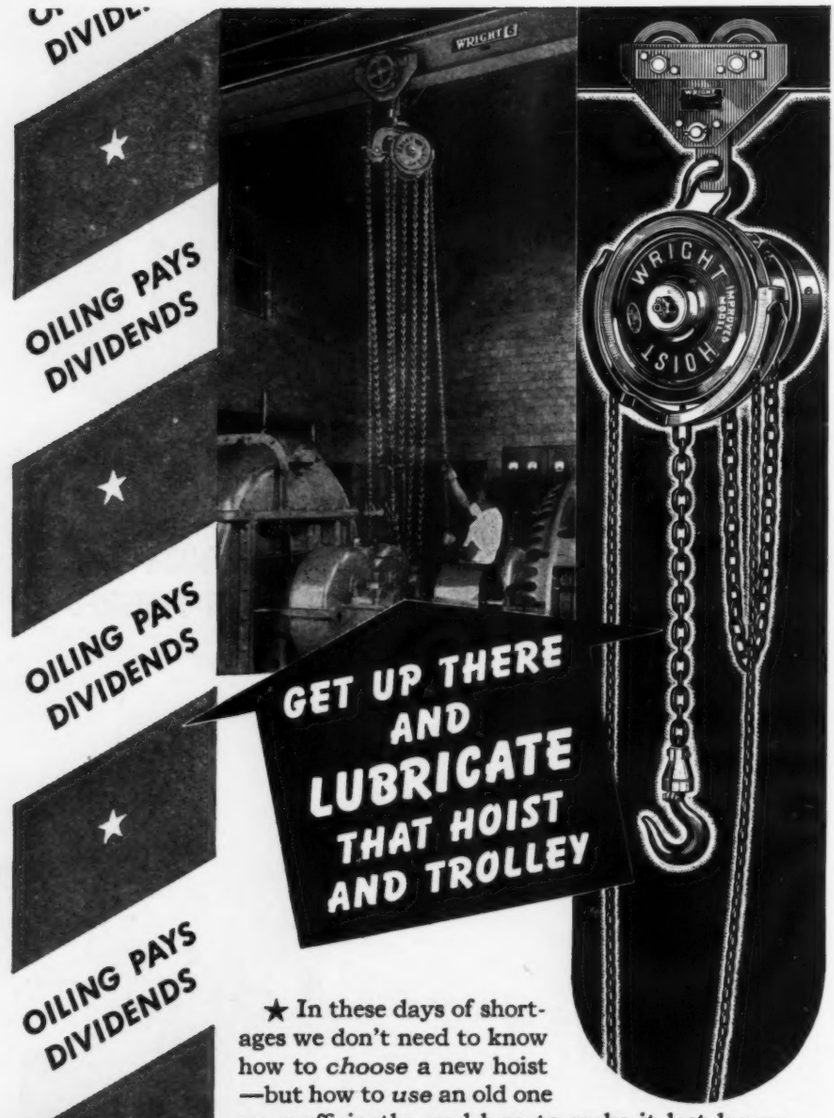
INDUSTRY LOOKS TO TOLEDO
FOR ALL TYPES OF SCALES



★ In these days of shortages we don't need to know how to *choose* a new hoist —but how to *use* an old one more efficiently, and how to make it last longer.

So—get busy with the grease gun! Where properly lubricated and maintained, many **WRIGHT HOISTS** have given constant, trouble-free service for 20 and 25 years. We have known other hoists to be so badly abused they were ruined in *two* years. Your **WRIGHT HOIST** will last indefinitely if you treat it right.

If your hoist is under constant use, as on assembly line work, inspect and lubricate it every month. If it is subjected to ordinary occasional service, then perhaps lubrication every three months and inspection every six months is sufficient. But keep your load chain well lubricated at all times. A lubricated chain will *far* outlast a dry chain.

Conserve steel and maintain production schedules by regular inspection and lubrication.

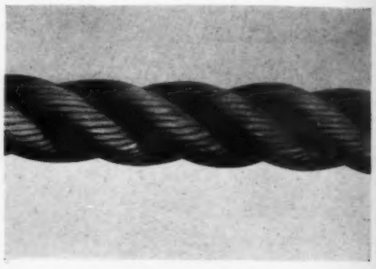
WRIGHT MANUFACTURING DIVISION
YORK, PENNSYLVANIA
In Business for Your Safety

ACCO
AMERICAN CHAIN & CABLE COMPANY, INC.
BRIDGEPORT, CONNECTICUT

Cleveland firm which has just completed a major expansion move in order to enter high production of machine guards, gear castings, pans, and housings for machine tool builders. For instance, a drill press guard is made of welded 16-gage sheet steel. Holes were punched in the top instead of being drilled, and an incurving flange, which improved the operation of the guard (but which could not be obtained by casting), was added. In addition, the fabricated part is stronger, more durable, less liable to breakage, takes less time to make, and costs less money than the casting. Light bases and frames are similarly lending themselves to sheet metal fabrication.

Rope

To fill hundreds of needs for rope in other than direct war industries, War Eagle all-sisal rope has been developed. Made of pure sisal fiber its strength is



80 percent of that of first-grade manila rope. It is lubricated with No. 1 cordage solution making it waterproof and resistant to rot, mildew, and drying out. American Manufacturing Co., Noble & West Sts., Brooklyn.

Paints for Defense

Vita-Var blackout paint, for use on windows, skylights, glass doors, or any surface it is desirable to blackout, forms a tough, elastic film that will not wash off in the rain it is claimed. It is a permanent coating and does not have to be renewed, although it can easily be removed by a razor blade scraper or paint and varnish remover. Is not affected by atmospheric conditions or by moisture and temperature conditions inside the plant. Used on the outside of windows it also prevents the reflection or glare from exterior sources of light. Can be used on wood, metal, concrete. Vita-Var Corp., Newark.

Watthour Meter Protector

For preventing damage due to lightning surge voltages, indoor watthour meter protector is announced. Known as type A, unit has a line to ground rating cutoff of 500 volts rms, a 60-cycle gap breakdown of 800 to 1,200 volts rms., and a discharge capacity of 20,000 amps. crest. Circuit voltage range is from 110 to 575 volts on 3 phase circuits. Consisting of an assembly of porous block elements and series gaps, protector is inclosed in a round aluminum case filled with non-

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GIVES YOU FIVE OTHER IMPORTANT FEATURES . . .

★ One-piece electroforged steel construction for guaranteed strength!

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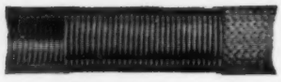
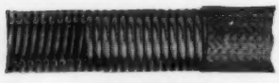


Type RW-81
(annular corrugations)



Type RW-91
(helical corrugations)

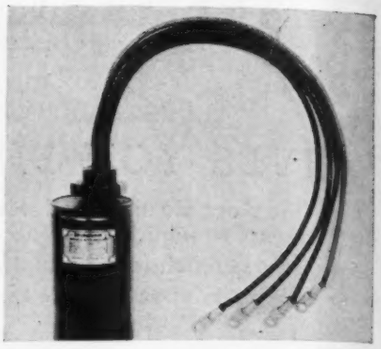
***REX-WELD* (corrugated)**
Flexible METAL Hose

Sizes from ⅛" I. D. to 4" I. D. inc. Pressures to 14,500 p.s.i. Temperatures to 1000° F. One-piece, all-metal construction. Continuous lengths to 50 feet.

Rex-Tite Mechanical (Re-attachable) couplings; solder couplings; brazed and welded couplings and flange assemblies for Rex-Weld Flexible Metal Hose.

Complete Data on Request

CHICAGO METAL HOSE
CORPORATION
MAYWOOD, ILLINOIS



inflammable compound. Can be mounted by a conduit through one of the knockouts in a connection box on which watthour meters are mounted. Nipple on the protector is 1¼ inches long and is offcener to move the protector for clearance if mounted under the connection box. Westinghouse Elec. & Mfg. Co., East Pittsburgh.

Steel Strapping Stretcher

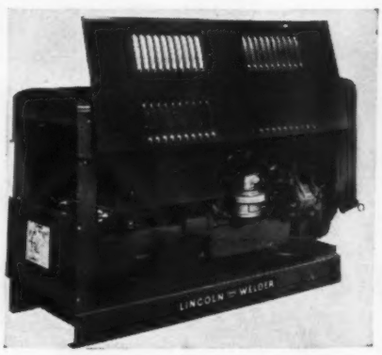
Stretcher for steel strapping, on which the "foot" or base has been eliminated makes possible the right binding of noncompressible packages and proper strapping with small surface dimensions.

Shipments made up of solid, non-compressible pacakages with 90 degree corners, which must be strapped so that the utmost of binding tension remains after the stretcher is removed, and other "problem packages" such as welding rods packed in small surfaced boxes, steel coils with narrow-faced sides, small bundles of steel squares, flats, etc., can be strapped with these tools, known as "fork type" stretchers. Signode Steel Strapping Co., 2600 N. Western Ave., Chicago.

Engine-Driven Arc Welder

Of 200-amp. size, unit is engineered for profitable welding applications of all types and sizes. With a current range of 40 to 250 amps. the machine can be used for welding light gage metal, for repair of cast iron parts such as engine blocks, for fabrication of machine parts and structures of many kinds, and for hardfacing worn parts. Of direct current type, it can weld effectively practically all metals and alloys with bare or shielded arc type electrodes or with the carbon arc where desirable. Compactness and light weight make it readily portable.

Machine's self-indicating voltage and



HERE'S a way to put your plant in better shape for increased output in the months ahead — with *present* machines and equipment: Call in a Gulf engineer and let him work with your plant men to improve lubrication practice. For the proper application of the right lubricants is a vital requirement for maximum production—it helps to insure full capacity performance from machines—and freedom from breakdowns and mechanical troubles.

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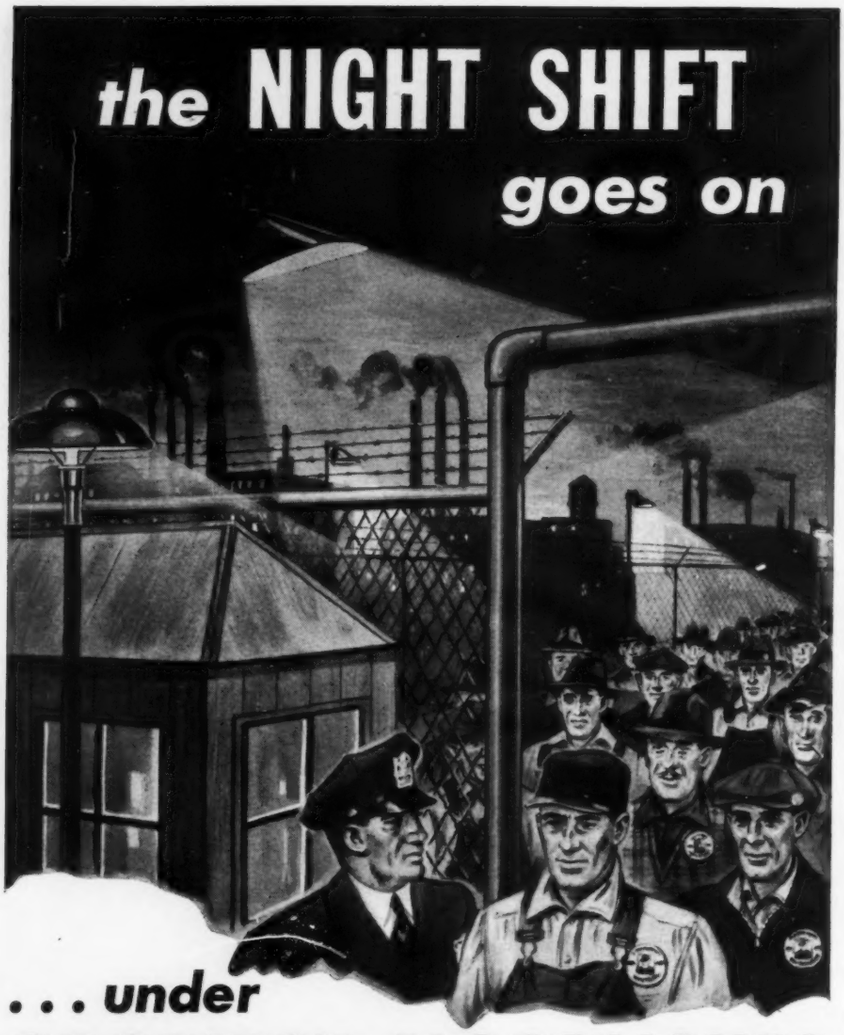
the NIGHT SHIFT goes on



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● Here they come—chins up, with the will to win—these men who fight the night battles of production! Nothing must interfere with their work; nothing must slow them in this race to arm America—quickly!

During these critical nights, floodlighting is indispensable around defense plants. For bright illumination is essential to quick and positive identification . . . to prevent the sly approach of saboteurs who seek to interfere with the swift flow of production.

All over America, Goodrich Floodlights are performing this important service in the interests of National Defense. Those seeking helpful information on the subject of protective lighting should write us for Folder No. 101, *"Plant Protection."*

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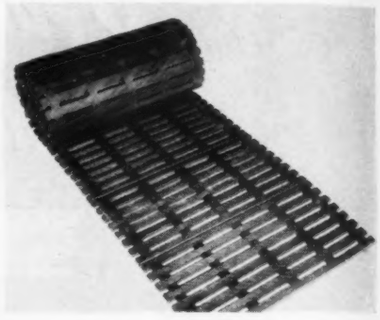
current control make it easy for the operator to select any type of arc and any arc intensity to suit the job. The welder will generate its rated current of 200 amps. at 1,400 rpm and engine speeds above that are only necessary for currents in excess of 200 amperes. The generator is single-operator, variable-voltage type with laminated pole pieces. The unit is equipped with exclusive "dual continuous control," enabling variation of both open circuit voltage and welding current, independently. The Lincoln Electric Company, 12818 Coit Ave., Cleveland.

Matting

Floor matting to be known as Neo-Cord Counter-Tred, is designed to have all the advantages of a rubber mat, plus non-skid safety features, and to be oil-resistant. It is said to make available the use of matting



in many fields where prevailing oily conditions destroyed ordinary rubber matting. A non-slip working surface has been attained by fabricating cords on end into the mat. American Mat Corp., 1745 Adams St., Toledo, Ohio.

Refrigerators

Industrial type sub-zero Cold Treater refrigerators maintaining temperatures down to —35 deg. Fahrenheit for laboratory research and testing, and production processing, aging, manufacturing, and assembly can be used in airplane, chemical, rubber, machinery, instrument, and other industries.

Built in 3- and 6-cu.ft. capacities. Large single lid gives complete access to

NO PRIORITIES ON ENGINE WEAR!

WEAR is still unrestricted..it continues regardless of material shortages. Now, more than ever before, you need the positive protection of AIR-MAZE Air Filters to make your present equipment LAST LONGER.

Only AIR-MAZE Air Filters have this famous AIR-MAZE Filter Element

Reduce Abrasive Wear with this

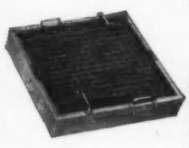
OIL BATH TYPE

Removes more than 99% of abrasive dust and grit, with less than 1.5" H_2O pressure drop. Will not clog. Easily installed on engines, compressors, blowers, etc. Automatic oil bath action constantly cleans filter element.

An Effective Spark Arrester and Air Filter

UNIMAZE TYPE

A highly efficient viscous-coated filter designed for smaller applications, such as automotive, aircraft and marine. Easily installed. Quickly cleaned. U. L. approved spark arrester. Only ⅛" H_2O restriction.



"Trap" Dust, Moisture, Paint, Oil with

PANEL TYPES

Permanent – need no replacement. Easily cleaned and recharged. All metal construction. Fire resistant. Highly efficient–99.83%. Low restriction. Made in various models for diverse applications–from air-conditioning to paint spray booths. In all reasonable sizes and shapes to fit existing frames.

Eliminate Objectionable Intake Noises with

FILTER-SILENCER TYPE

More than a silencing device "added on" to a filter. Highly efficient accoustical chamber is integral part of filter. Effectively eliminates objectionable intake noises–at same time provides 99% *plus* air filtering efficiency. Available with oil bath *or* viscous type filter element.

It's always good business to give your equipment the best of care—to get maximum service with the minimum of maintenance. TODAY, it's even more important. Your engines, compressors and blowers will have to *work harder* and *last longer* if America's "all out" program is to succeed.

Good Air Filter protection is just as essential as good lubrication in preserving your equipment at peak efficiency. Abrasive dust and grit, entering the air intakes, can quickly impair performance, cause unnecessary overhauls, create costly delays and shorten the life of any precision equipment.

And when you specify, be sure it's AIR-MAZE—the patented, all-metal air filter providing higher air filtering efficiency with extremely low pressure drop—scientifically designed to utilize the baffle impingement principle in its highest degree.

Made in a wide range of sizes, shapes and capacities to solve nearly every air filtering problem. For further information, without obligation, write us direct.

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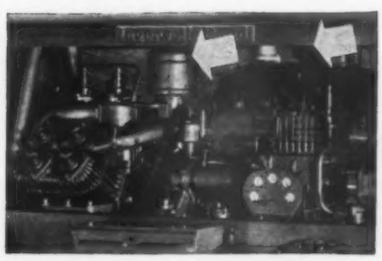
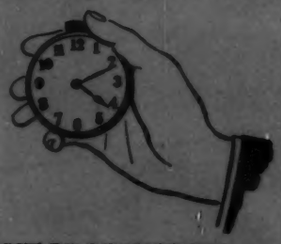
THIS PORTABLE *engine-driven compressor is doubly protected by AIR-MAZE. Both air intake of compressor and engine are equipped with AIR-MAZE Oil Bath Type Air Filters, shown by arrows.*



AIR-MAZE

DEPENDABLE AIR FILTERS FOR EVERY APPLICATION

5 Proved Time-Savers for ALL-OUT PRODUCTION



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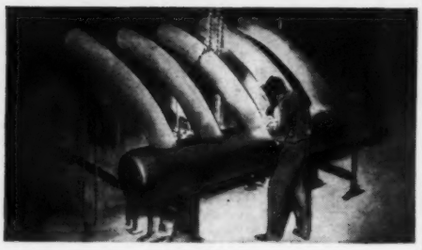
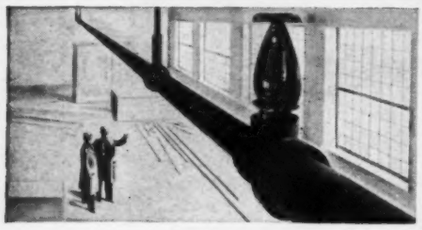
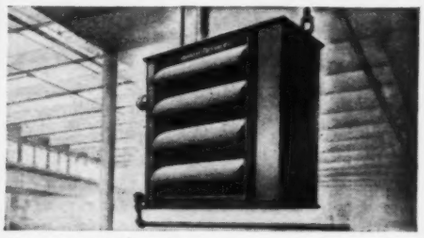


1 — **Grinnell Prefabricated Piping** saves construction time.

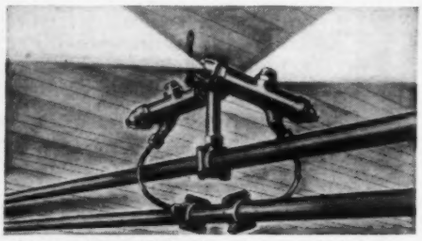


2 — **Grinnell Automatic Sprinklers,** installed with minimum disruption, guard against time and material loss by fire.



3 — **Grinnell Thermoliers** provide efficient, uniform heating — help speed output.

4 — **Grinnell Pipe Fittings** for stronger, tighter pipe connections, minimize repairs and delays.



5 — **Amco** Humidification Systems help textile mills speed production of uniforms and defense fabrics.

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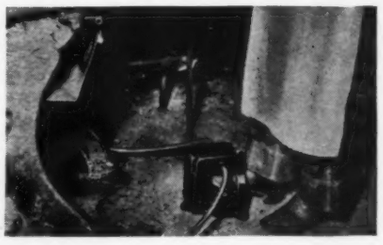
interior. Equipped with self-contained, trouble-free sealed condensing unit ready to plug in and use. Standard control maintains temperatures from +5 down to —10 deg. Fahrenheit. Special control gives temperatures from +20 to —35 deg. Fahrenheit. Cabinets available with any specialized types of containers, racks, or shelves. The Jewett Refrigerator Co., Inc., 48 Letchworth St., Buffalo, N. Y.

Heavy Duty Electric Hoist

Features claimed for the CM Meteor heavy duty electric hoist include streamlined design that provides compactness and eliminates excess weight; airplane type cooling fins that quickly dissipate the heat generated by gears and load brake; fully inclosed, weatherproofed design that permits hoist to be used indoors and out; and, for extra safety, full inclosed safety-type hook blocks, and a specially designed electrical system that permits only 110 volts to pass through the pushbutton station. Available in capacities of ½ ton and up. Chisholm-Moore Hoist Corp., Tonawanda, N. Y.

Pneumatic Foot Pedal

A recent study of operators using power presses in a large plant revealed that an average day called for 10,000 trips of a 4-in. stroke mechanical pedal. Schrader pneumatic foot pedal cuts this effort to a tip-toe 1½ in. stroke without lifting the foot from the floor. Can be operated with



either foot. It is portable and permits various angles of approach. Where work necessitates standing away from the machines, pedal can be brought out to allow practical operation in an erect position. Offers remote control and eliminates unnecessary steps and waste motion. A. Schrader's Son, 470 Vanderbilt Ave., Brooklyn, N. Y.

Lubricating System

Many new features are incorporated in Lincoln Centro-Matic latest centralized lubricating system it is claimed. System consists of a number of injectors, one for each bearing to be lubricated, each connected to the bearing by tubing or flexible high-pressure hose as required, and each individually adjusted to discharge the required amount of lubricant. The injectors can be mounted singly or in manifold, and are supplied with lubricant from a central pumping unit.

A feature claimed for system is the single lubricant supply line between the pumping unit and the Centro-Matic injectors. Another is the wide range of

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***PREPARE** now for tomorrow's keenly competitive markets.. get HOBART Arc welding*

You'll find Hobart Arc Welders all over the country, in every metal working division of the defense industry. Hobart Welders are designed and built to deliver continuous duty service . . . and after the war they'll still be delivering the same high quality welds with speed and economy. It's the kind of a welder you need . . . speed for today; stamina for tomorrow!

Greater Speed With Hobart "Simplified" Arc Welding production speed is increased because correct welding heat for every type of metal and rod is instantly available. The exclusive Remote Control* saves valuable time by eliminating the need to return to the welder to make adjustments when changing rods or position.

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Better Welds With the exclusive Hobart Multi-Range Dual Control you have your choice of 1,000 combinations of welding heat, taking all guesswork out of weld control. Use coupon for details.

Hobart Brothers, Box U-22, Troy, Ohio, U.S.A.
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**** Exclusive REMOTE Control***

By removing this dial from the Hobart Welder you can make heat changes at the work, without the usual necessity of returning to the machine when changing rods or position. Saves time and money for you.

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Regardless of the metal or alloy with which you are now working, you'll find a Hobart Electrode that will handle the work satisfactorily. The new Hobart Handbook EW-79 lists the complete line with specifications and recommendations. Write for your copy of this practical handbook today.

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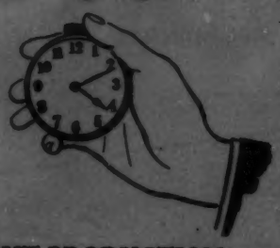

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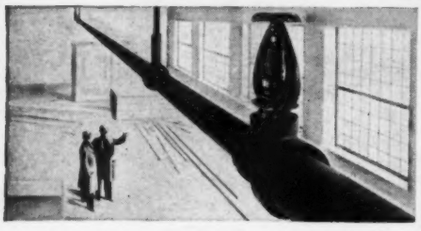

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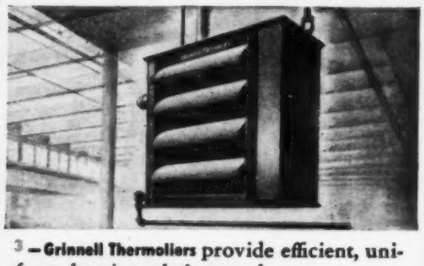

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interior. Equipped with self-contained, trouble-free sealed condensing unit ready to plug in and use. Standard control maintains temperatures from +5 down to −10 deg. Fahrenheit. Special control gives temperatures from +20 to −35 deg. Fahrenheit. Cabinets available with any specialized types of containers, racks, or shelves. The Jewett Refrigerator Co., Inc., 48 Letchworth St., Buffalo, N. Y.

Heavy Duty Electric Hoist

Features claimed for the CM Meteor heavy duty electric hoist include streamlined design that provides compactness and eliminates excess weight; airplane type cooling fins that quickly dissipate the heat generated by gears and load brake; fully inclosed, weatherproofed design that permits hoist to be used indoors and out; and, for extra safety, full inclosed safety-type hook blocks, and a specially designed electrical system that permits only 110 volts to pass through the pushbutton station. Available in capacities of ½ ton and up. Chisholm-Moore Hoist Corp., Tonawanda, N. Y.

Pneumatic Foot Pedal

A recent study of operators using power presses in a large plant revealed that an average day called for 10,000 trips of a 4-in. stroke mechanical pedal. Schrader pneumatic foot pedal cuts this effort to a tip-toe 1½ in. stroke without lifting the foot from the floor. Can be operated with

either foot. It is portable and permits various angles of approach. Where work necessitates standing away from the machines, pedal can be brought out to allow practical operation in an erect position. Offers remote control and eliminates unnecessary steps and waste motion. A. Schrader's Son, 470 Vanderbilt Ave., Brooklyn, N. Y.

Lubricating System

Many new features are incorporated in Lincoln Centro-Matic latest centralized lubricating system it is claimed. System consists of a number of injectors, one for each bearing to be lubricated, each connected to the bearing by tubing or flexible high-pressure hose as required, and each individually adjusted to discharge the required amount of lubricant. The injectors can be mounted singly or in manifold, and are supplied with lubricant from a central pumping unit.

A feature claimed for system is the single lubricant supply line between the pumping unit and the Centro-Matic injectors. Another is the wide range of

PREPARE now for tomorrow's keenly competitive markets.. get HOBART Arc welding

You'll find Hobart Arc Welders all over the country, in every metal working division of the defense industry. Hobart Welders are designed and built to deliver continuous duty service . . . and after the war they'll still be delivering the same high quality welds with speed and economy. It's the kind of a welder you need . . . speed for today; stamina for tomorrow!

Greater Speed With Hobart "Simplified" Arc Welding production speed is increased because correct welding heat for every type of metal and rod is instantly available. The exclusive Remote Control* saves valuable time by eliminating the need to return to the welder to make adjustments when changing rods or position.

New Economy Because of its long life operating speed and cool operation, the Hobart Welder delivers high quality welds continuously, often doing the work of two ordinary welders. Close volt-amp. control reduces amount of costly rejects and further savings are produced by lowered current costs.

Better Welds With the exclusive Hobart Multi-Range Dual Control you have your choice of 1,000 combinations of welding heat, taking all guesswork out of weld control. Use coupon for details.

Hobart Brothers, Box U-22, Troy, Ohio, U.S.A.
"One of the World's Largest Builders of Arc Welders"

**** Exclusive REMOTE Control***

By removing this dial from the Hobart Welder you can make heat changes at the work, without the usual necessity of returning to the machine when changing rods or position. Saves time and money for you.

Have You Tried HOBART Electrodes?

Regardless of the metal or alloy with which you are now working, you'll find a Hobart Electrode that will handle the work satisfactorily. The new Hobart Handbook EW-79 lists the complete line with specifications and recommendations. Write for your copy of this practical handbook today.

Speed Up Production with
HOBART
"Simplified" **ARC WELDERS**

Ask for Your Copy!

This beautiful 3-color catalog showing the complete line of Hobart Welders and specifications on the different models.
USE THE COUPON!

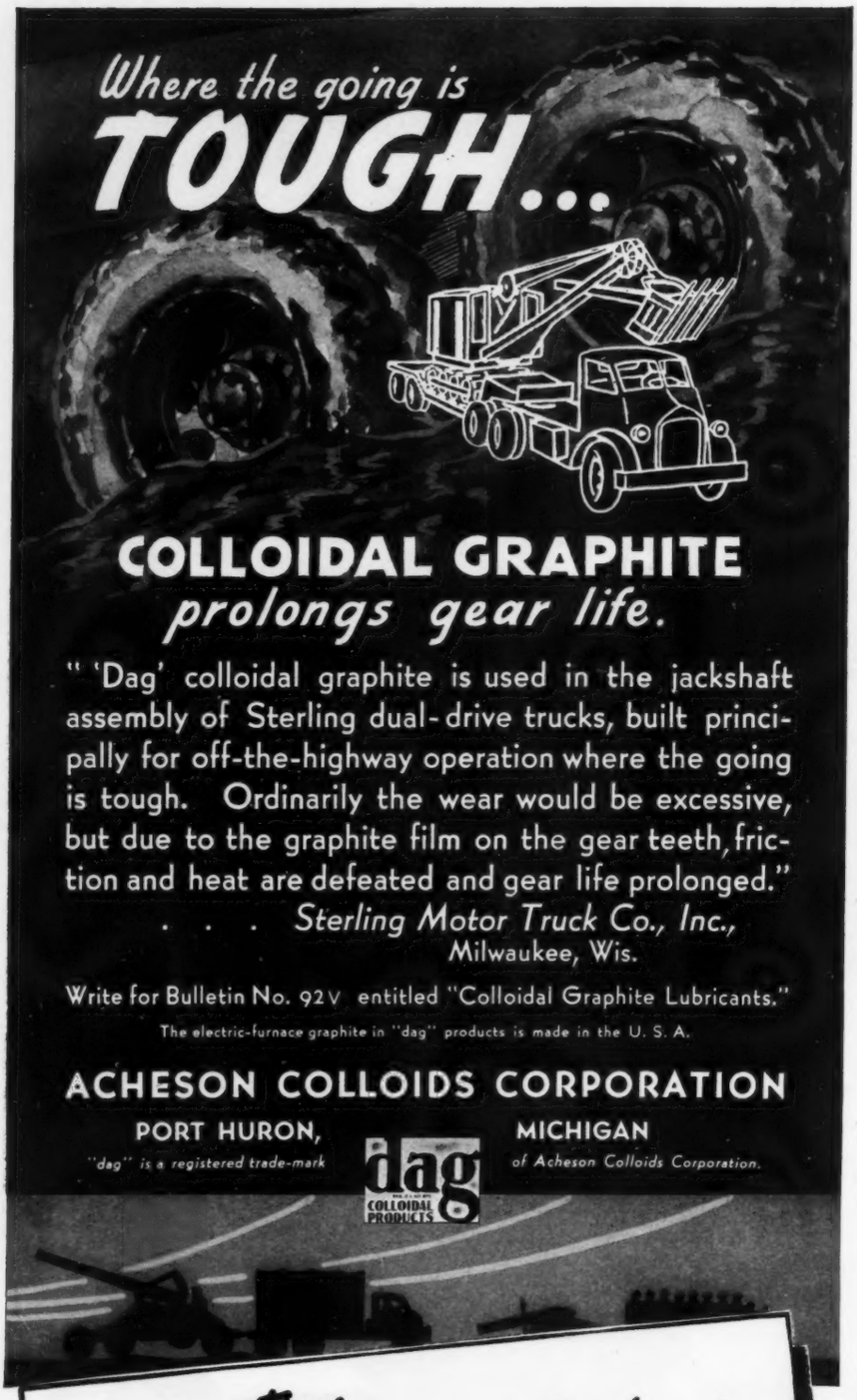
● **Hobart Brothers Co., Box U-22, Troy, Ohio, U.S.A.**

Send me at once a FREE copy of the New Hobart Catalog, complete with details and specifications. I'm especially interested in:

☐ Electric Drive ☐ Gasoline Drive ☐ Hobart Electrodes
☐ Send details on the new Hobart Arc Welding Trade School.

NAME_____

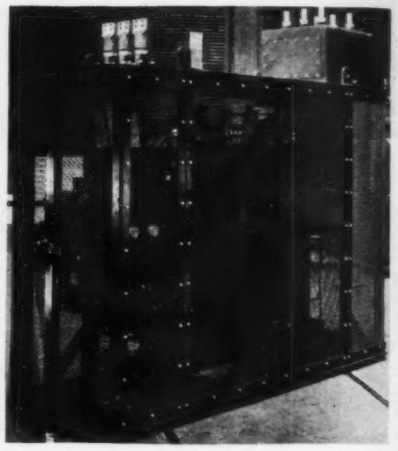
ADDRESS_____


Where the going is
TOUGH...
COLLOIDAL GRAPHITE
prolongs gear life.
" 'Dag' colloidal graphite is used in the jackshaft assembly of Sterling dual-drive trucks, built principally for off-the-highway operation where the going is tough. Ordinarily the wear would be excessive, but due to the graphite film on the gear teeth, friction and heat are defeated and gear life prolonged."
. . . Sterling Motor Truck Co., Inc.,
Milwaukee, Wis.
Write for Bulletin No. 92V entitled "Colloidal Graphite Lubricants."
The electric-furnace graphite in "dag" products is made in the U. S. A.
ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN
"dag" is a registered trade-mark
of Acheson Colloids Corporation.
dag
COLLOIDAL PRODUCTS
To Industry: "Dag" Colloidal Graphite is a lubricant – resists extreme temperatures and pressures – is electrically conductive, opaque and chemically inert – can be suspended in many liquids including the lighter viscosity fluids.

pumping units now available, and the varied types of control. Pumping units with 30-lb. capacity, as well as pumps that handle lubricants direct from 100-lb. and 400-lb. capacity original drums are available, and system can be either electrically operated with pushbutton control, or entirely automatic with timeclock control. Lincoln Engineering Co., 5701 Natural Bridge Ave., St. Louis, Mo.

Distribution Unit

Especially designed for industrial plants using secondary network systems, air-cooled network distribution unit consists of a high-voltage double-throw primary transfer switch, an air-cooled 3-phase transformer, and network protector, housed as a single unit. Transforms power from the primary voltage to secondary grid voltage. Ratings are from 300 to 1,000 kva on all



standard voltages between 2,300 and 13,800 with secondary voltages of 125/216 four wire, 226/460 four wire, and 460 three wire.

Primary air-break switch opens the exciting current of the associated transformer and will withstand a short-circuit current of 10,000 amps. for two seconds without damage to or appreciable movement of its parts.

The 3-phase transformer is of the dry type, air-cooled, and insulated with non-inflammable materials. It is designed to carry rated kva at normal voltage and frequency without exceeding 75 deg. C. rise above an ambient temperature of 40 deg. C. High voltage windings are delta-connected with four 2½ percent full capacity taps below normal; low voltage windings may be star or delta connected with no taps.

Network protector is the 3-pole type securely mounted in the low-voltage end of the unit housing and adequately spaced and barriered from all high-voltage circuits of the unit to permit inspection, test, and maintenance without danger of contacting high voltage portions. Westinghouse Elec. & Mfg. Co., E. Pittsburgh.

Fluorescent Starter

Fluorescent lamp starters, designed to protect ballast and starter and to eliminate the flashing of failed lamps are known as

Everywhere... SKILSAW TOOLS are at the Front in the Battle of Production!

Skilsaw Disc Sanders—6 Models. Speed up all sanding, grinding, filing, metal cleaning and polishing on flat or curved surfaces of wood, metal, compositions.

Skilsaw Belt Sanders—4 Models. Finish *faster—smoother* on wood, metal, stone or compositions. Ideal for every job from coarsest sanding to finest honing.

Skilsaws—9 Models. Speed up all sawing. Save time in plant expansion, remodeling, maintenance. Cut flat or corrugated metal in production.

Skilsaw Drills—23 Models. More drilling power—more holes per hour, speed up all drilling from lightest production work to heaviest boring and reaming.

Wherever the fight for production is fiercest—wherever war materials are being built fastest you'll find SKILSAW TOOLS at work . . . speeding up jobs in every industry . . . making each man, each minute more productive . . . saving days and dollars for quicker Victory!

SKILSAW TOOLS are rugged, reliable, powerful. They work faster, handle easier and do more kinds of jobs. That's why they're preferred so widely in plants making aircraft, tanks and other war materials. That's why they belong in your plant, too, to build *fast* what America needs right now! Ask for a demonstration of SKILSAW TOOLS.

SKILSAW, INC., 5043 Elston Avenue, Chicago

New York • Boston • Buffalo • Philadelphia • Cleveland • Detroit • Indianapolis • St. Louis
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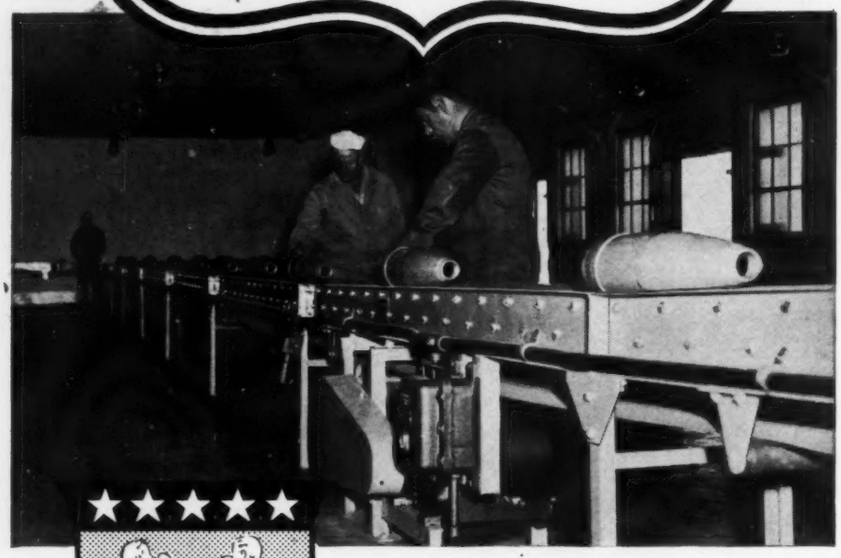
SKILSAW PORTABLE ELECTRIC TOOLS

★ *FOR THE DEFENSE OF AMERICA* ★

THE WAR CAN BE WON IN *your* PLANT !



YOUR PLANT — like every other American factory — is constantly battling the waste motion and inefficiency of "stop and go" handling of war materials.

Wherever Alvey - Ferguson Scientifically Planned Conveying Systems have been installed, however, the efficiency and economy of "endless stream" production have been apparent immediately.

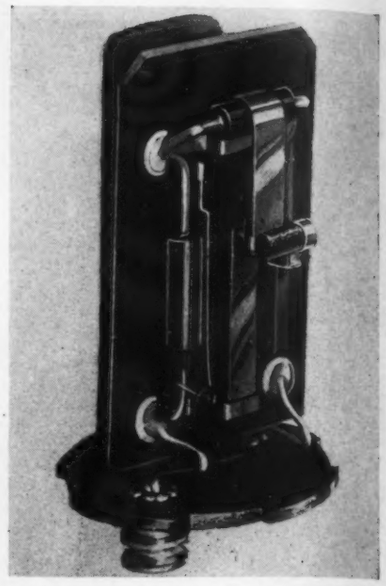
Where faster washing of products is needed, A-F Super Spray Metal Product Washing Machines have been found to be the answer.

To solve your materials handling, product handling or product washing problems write, wire or phone, without obligation on your part, for a discussion with an A-F Conveyor Engineer. Or write for catalogs—today!

THE ALVEY-FERGUSON CO.
123 DISNEY ST. CINCINNATI, OHIO

CONVEYING A-F MACHINERY

ALVEY-FERGUSON *Conveyors*
AND PRODUCT WASHING MACHINES



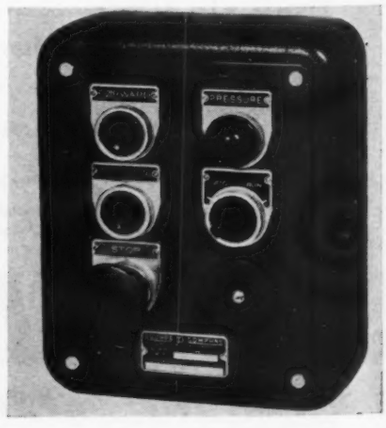
the Hygrade Premium Mirastat Starters. Automatically opening the circuit when a lamp fails, these starters are especially suitable for jobs where quick replacement of a burned-out lamp is impractical. Hygrade Sylvania Corp., Salem, Mass.

Pressure Booster

For pressure testing castings, manifolds, regulators, pressure vessels, high pressure hose, or calibrating gages and recorders right in the field, hydraulic pressure booster is self-contained and compact. Simple and easy to operate, having no motors, no gears, and no delicate parts. Can produce up to 55,000 lb. per sq.in. pressure by a hand-pump operation. Equipped with a 30,000-lb. master gage, permitting a wide range of testing applications. Fast, flexible operation enables pressure to be maintained constantly or released instantly, as desired. Can be built to deliver any reasonable pressure required and can be equipped with a master gage calibrated in any scale. Martin-Decker Corp,. Long Beach, Calif.

Multiple Unit Machine Control Stations

Series of Class 9001, Type M, pushbutton stations and inclosures of heavy cast construction, provide protection against acci-



YOUR BUSINESS —AND OURS IS VICTORY

TODAY, your business—and ours is the battle of production. It's a relentless battle of men and machines and power against time, treachery and death for our fighting men. It's a battle in which V-Belts are vital lifelines of dependable power transmission.

For 21 years Dayton has pioneered V-Belts which we honestly believe are unmatched for performance and economy.

And for the duration we intend to make such V-Belts consistent with the quantity and material sanctions imposed by a Government which asks us all to work as one in the greatest Production Battle ever waged by free men for all mankind.

To that end and its promise of ultimate victory we dedicate, as do you, our hands, our hearts and our brains. And we ask your help in conserving all materials so vital to victory for which all of us must work together as never before.

THE DAYTON RUBBER MFG. COMPANY, DAYTON, OHIO
The World's Largest Manufacturer of V-Belts
DAYTON RUBBER EXPORT CORP., 38 Pearl St., New York, N.Y., U.S.A.

Copyright, 1942, The Dayton Rubber Manufacturing Co.

V-BELTS ARE VITAL TO VICTORY... HELP CONSERVE THEM THESE WAYS

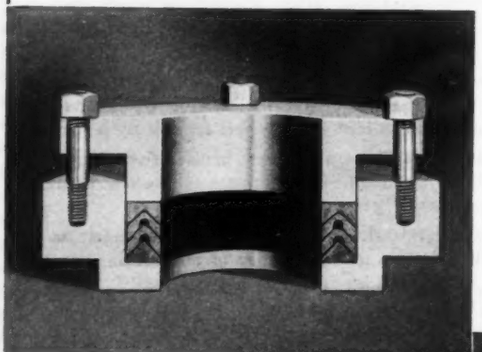
1. When installing, don't pry V-Belts over pulley grooves—instead, slide motor forward and drop belts over pulleys. Then move motor back until proper tension is obtained.
2. When proper tension is reached, belts have "live springy vibration." When too much slack exists, belts feel dead when struck by hand.
3. Check and line up pulleys, groove for groove, and in parallel. Misalignment wears both belts and pulley grooves.
4. Check both shafts for parallel alignment so each belt can pull its share of the load.
5. Check and replace worn pulleys—they wear out belts prematurely.
6. Don't replace a *part* of a set of V-Belts with new belts as the new belts will hog the load and wear out quickly. *Replace the whole set* and conserve any good belts from the old set for spares.

Dayton V Belts
LIFELINES OF POWER TRANSMISSION
VITAL TO VICTORY

FOR EFFICIENT *All-Out* PRODUCTION

GARLOCK

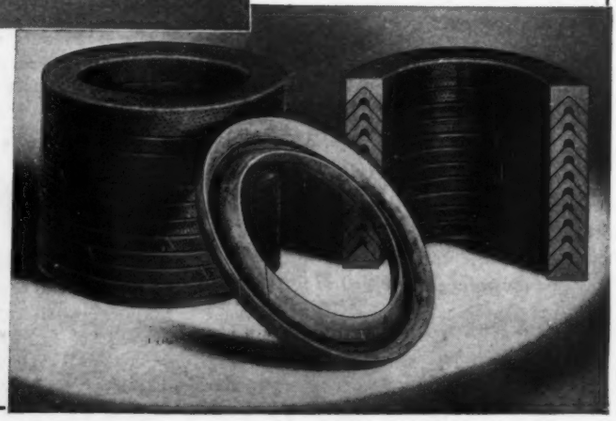
An outstanding GARLOCK Packing for *long, dependable* service is GARLOCK CHEVRON, illustrated below. Like other GARLOCK Packings, CHEVRON permits you to avoid frequent shut-downs for re-packing . . . helps you maintain your share of the all-out, full-capacity production needed for Victory.



THE GARLOCK PACKING CO.
Palmyra, N. Y.

In Canada:
The Garlock Packing Company of Canada Limited Montreal, Que.

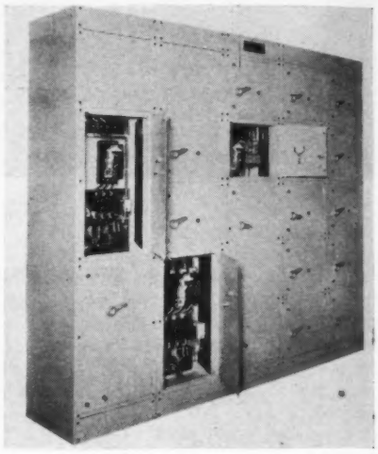
GARLOCK 430 CHEVRON for hydraulic service. 431 for oils at low temperatures. 530 for steam, air or gas. 531 for hot oils.



dental damage to control units. Available for 3, 6, 9, 12, and 16 pushbutton, selector switch, or pilot light control units. Each may be furnished as an assembled station or as an inclosure only. Closing plate assemblies are provided for unused openings in the cover plate. Inclosure consists of a cast-iron case, gasket, and steel cover plate. Case may be drilled and tapped for conduit entrance in five locations. Industrial Controller Division, Square D Company, 6060 Rivard St., Detroit.

Motor Control Center

For group of a.c. motors up to 100 horsepower for industrial use, control center with interchangeable units is available in 76- and 90-in. heights, with centers consisting of (a) a 7-in. filler at the top for horizontal buses and cable trough, (b) a 5-in. filler at bottom for cross cable duct, (c) an 8-in. filler for master terminal boards, and (d) multiples of the basic 14-in. starter unit heights. Units



are trim mounted 20 inches wide, permitting two to five control elements to be placed in a single section. Sections are 20 inches deep allowing sufficient depth to mount the units on each face.

For operation on 3-phase, 220, 440, and 550 volt circuits, the motor starter units consist of a full voltage magnetic starter providing external manual reset, thermal overload, and low voltage protection. The disconnect switches may be unfused, quick-make and quick-break, of the circuit breaker type with thermal inverse time overload and instantaneous short circuit protection. A fused disconnect switch is available up to 7.5 hp., 220 volts; 15 hp., 440 volts. Finished in black lacquer and assembled ready to receive line, motor and control circuit connections. Westinghouse Elec. & Mfg. Co., E. Pittsburgh.

Blackout Bulb

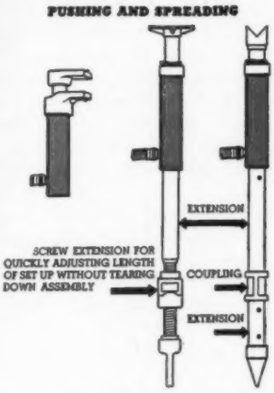
Designed for blackout lighting in air raids, blackout bulb just announced provides downlighting in a soft beam of blue light that is safe for indoor visibility during blackouts. Bulb is lined inside with a pure silver reflector lining that hides filament glare and projects the light downward. Light leaks are prevented by a black silicate coating that covers the bulb up to the

Porto-Power's Might Makes Right!

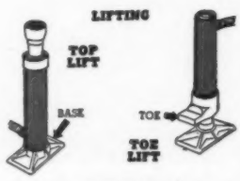
PORTO-POWER is a Hydraulic Jack which has its ram separated from the pump by a high-pressure hose. The ram thus works in all directions, and the plunger action is "harnessed" by simple attachments for pushing, pulling, spreading, pressing and bending over any span and angle.

TYPICAL PORTO-POWER SET-UPS

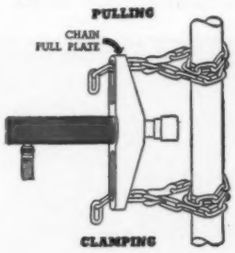
PUSHING AND SPREADING



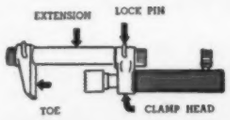
LIFTING

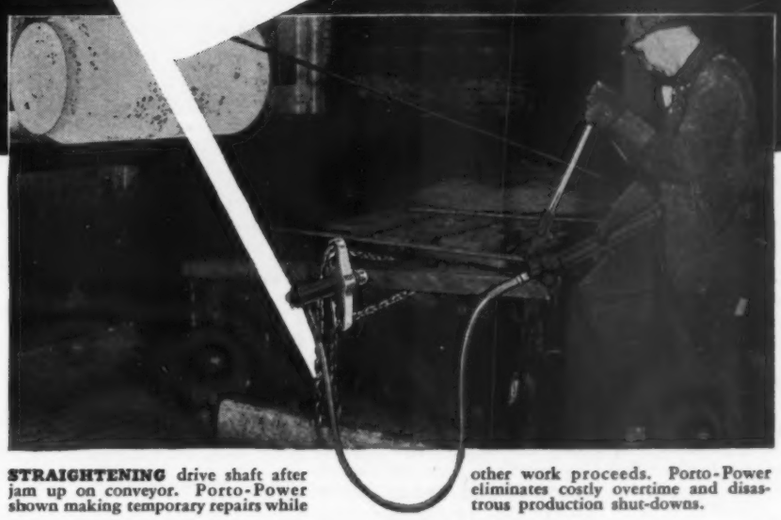


PULLING



CLAMPING





STRAIGHTENING drive shaft after jam up on conveyor. Porto-Power shown making temporary repairs while other work proceeds. Porto-Power eliminates costly overtime and disastrous production shut-downs.

YOU can best appreciate this development by first looking at your hand and imagining that it has 40,000* lbs. of power! Think of the push, pull, clamp, press, bend and spread jobs you could then do by applying that much pressure how, where and when you would want it! And you can with PORTO-POWER which does practically everything the hand can do. Porto-Power can save time on these and scores of other trouble jobs: Pulling gears, pulleys and wheels; lifting machinery; straightening shafts; inserting or removing pins, bushings, bolts and shafts.

**Model S-78. Others in 4,000, 8,000, 14,000, 20,000 and 100,000 Lb. capacities.*

***A Product of* BLACKHAWK MFG. CO., Dept. P2732, Milwaukee, Wis.**

Porto-Power eliminates a lot of inconvenient, dangerous, damaging, time-taking operations and use of costly mechanical devices. Every mill, mine, plant, shop and construction crew is coming to it! See your Blackhawk Industrial Distributor about Porto-Power.

THINGS YOU SHOULD KNOW

if you use pumps!

Things that make a big difference in performance between ROPER "hydraulically balanced" PUMPS and other pumps.

GEARS THAT FLOAT IN OPERATION SAVE YOU TIME AND MONEY! The pumping gears in ROPER "hydraulically balanced" PUMPS have hollow shafts so that internal pressure is equalized at all points. These gears are entirely separate from the drive shaft and are connected only by a sliding joint which permits them to actually "float" in operation. This sliding joint plus a special collar on shaft absorbs any shock or end thrust.

This feature means big savings in time and money for you because "hydraulically balanced" pumps are more efficient, last longer and permit periodic inspection of internal parts without disturbing piping or power unit.

REPLACEABLE BEARINGS GIVE PUMPS LONGER LIFE —The 4 large bearings (two on each side) in ROPER "hydraulically balanced" PUMPS are designed and constructed to withstand severe operating abuses and adequately handle peak loads. These flanged high lead bronze bearings also act as wearplates to protect face and backplate from wear. Can be replaced easily and inexpensively.

ROPER MECHANICAL SEAL REDUCES POWER REQUIREMENTS — Each ROPER "hydraulically balanced" PUMP is regularly equipped with a Roper Mechanical Seal. It saves money by reducing power consumption and keeps leakage to a minmum. Especially desirable where re-packing is not practical — that also saves you time and money.

HYDRAULICALLY BALANCED

THIS SEAL appears on every ROPER "hydraulically balanced" PUMP. It means higher efficiency, quieter operation, greater dependability and longer life.

SAVES FLOOR SPACE—ROPER PUMPS are designed to operate at direct motor speeds, thus eliminating gears, belts, etc. . . . saves space, and what plant doesn't need more space?

ALWAYS PRIMED — Once primed and in operation a Roper will always pick up its own prime — ready for instant action.

AS DEPENDABLE AS OLD FAITHFUL — That is the reputation earned by dependable performance year in and year out.

FREE CATALOG

Send for your free copy of Catalog 958 It contains complete information on 16 different sizes of Roper Pumps. Learn how you can save money and trouble on your pumping problems.

★

THIS HAPPENED FROM COAST TO COAST

United Air Lines say this about Roper Pumps on their refueling tank trucks . . . "first, they are SPEEDY and DEPENDABLE . . . second, their QUIET operation makes them ideal for refueling sleeper planes . . . third, they are the most EFFICIENT we have ever used . . ."

★

THIS HAPPENED IN ILLINOIS

A manufacturing plant was using five pumping outfits . . . average life of each pump, 16 hours and cost per pump, $46.65. Roper analyzed the problem and made recommendations. RESULT — average life of pump was s-t-r-e-t-c-h-e-d to 13 months. Net saving to customer in 13 months — $29,690.00.

★

THIS HAPPENED IN OHIO

Weaver-Wall Co., Cleveland, use Roper Pumps for pumping hot asphalt at temperatures up to 400° eight hours per day in the winter, twenty-four in the summer. Some test! But Roper Rotary Pumps endured for more than 12 years.

ROPER *Rotary* PUMPS

GEO. D. ROPER CORP. ★ ★ ★ ROCKFORD, ILLINOIS

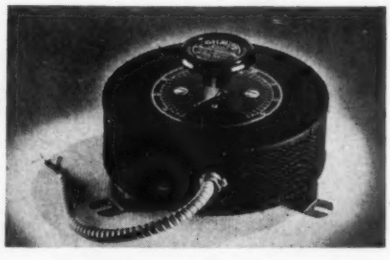
extreme lighting end, which is a deep blue. Consumes 25 watts. Wabash Appliance Corporation, 335 Carroll St., Brooklyn, N. Y.

Generators

Compact, streamlined, revolving field, a.c. generators are available in sizes from 7½ to 75 kva, 4, 6, or 8 pole, 1,800, 1,200, or 900 rpm, 60 cycle (corresponding speeds for other frequencies) for belt or coupling drive or flange mounting. Offered for continuous duty in isolated plants, or to supplement other available power supply. Wound for the various standard voltages, single phase 2 and 3 wire, three phase 3 and 4 wire, or two phase 4 wire. The neutral may be brought out for three phase 4 wire systems for light and power. Built to meet AIEE and NEMA voltage regulation standards. Can be designed for any desired value of power factor, but the regulation will be governed by the power factor. Century Electric Co., 1806 Pine St., St. Louis.

Rheostat Cages

Rheostat cage inclosure is convenient for table-top or surface mounting, and is advisable where there is possibility of mechanical injury to the rheostat or human contact with electrically live parts. Used in connection with fractional horsepower motor controls, heating device controls, and

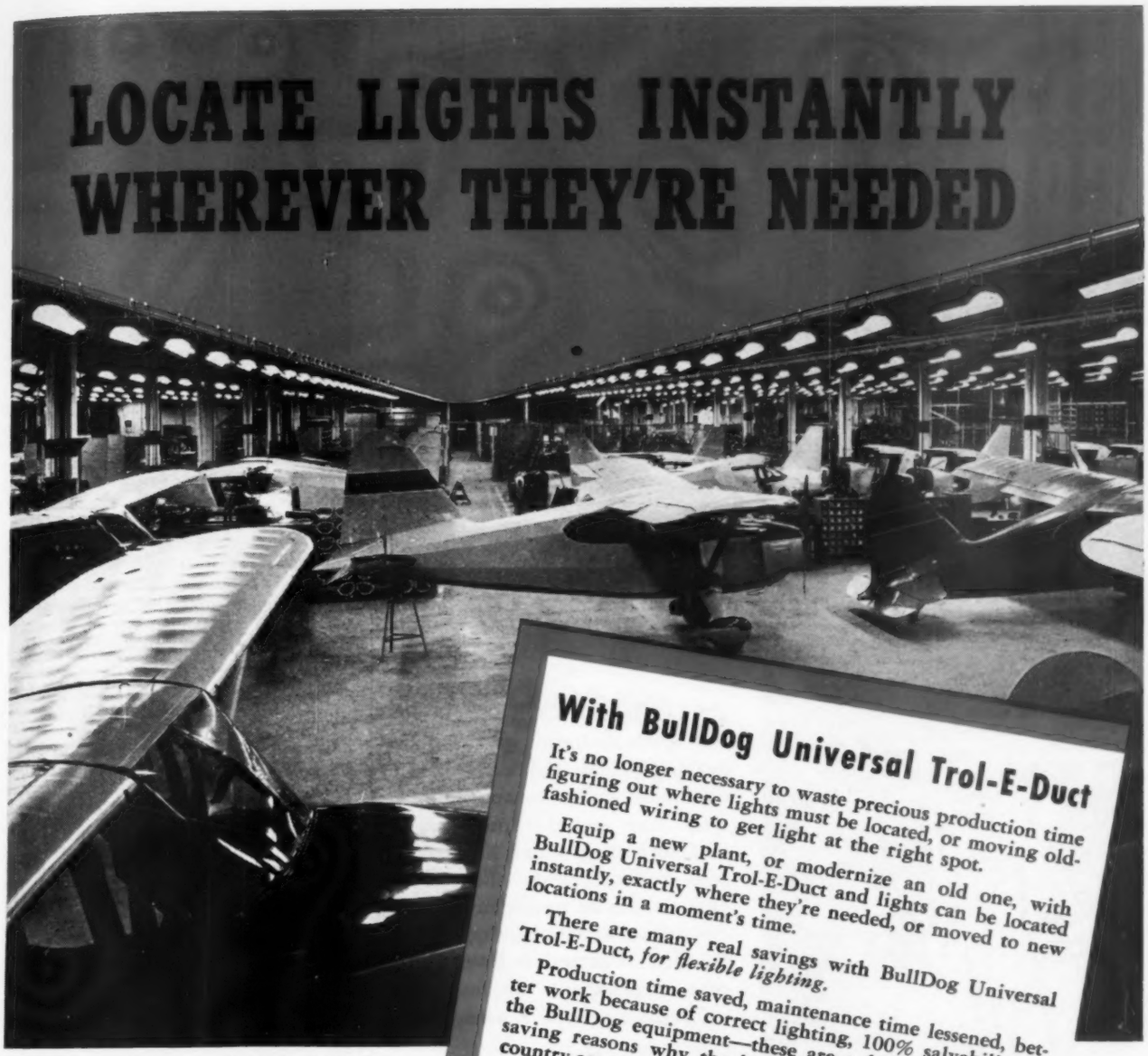


so on. Available are ventilated cages with perforated sides; dustproof cages; cages to house rheostats in tandem; explosion proof cages; ventilated cages with one-half closed as a splash guard; and a laboratory type semi-inclosed table-top cage. Various types of terminals can be supplied. Ohmite Manufacturing Co., 4835 Flournoy St., Chicago.

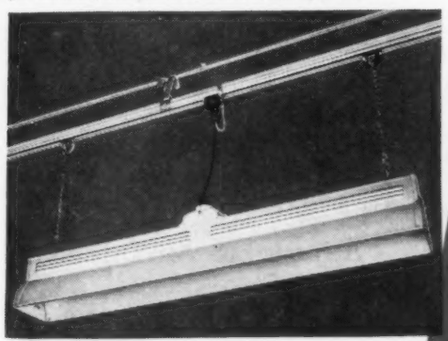
Sprinkler

The Rockwood N-20 waterfog nozzle generates "waterfog"—just ordinary water but broken up into such small particles

LOCATE LIGHTS INSTANTLY WHEREVER THEY'RE NEEDED



Parallel runs of BullDog Universal Trol-E-Duct supporting fluorescent fixtures furnish flexible lighting for this aircraft plant which builds trainers for the army and for the civilian training program.



A run of Universal Trol-E-Duct hung from messenger cable, and a typical industrial fluorescent fixture suspended from the Trol-E-Duct itself by weight supports. Current is supplied through the Receptacle Twistout Plug in which a fusible attachment plug is inserted for individual protection of the fixture.

With BullDog Universal Trol-E-Duct

It's no longer necessary to waste precious production time figuring out where lights must be located, or moving old-fashioned wiring to get light at the right spot.

Equip a new plant, or modernize an old one, with BullDog Universal Trol-E-Duct and lights can be located instantly, exactly where they're needed, or moved to new locations in a moment's time.

There are many real savings with BullDog Universal Trol-E-Duct, *for flexible lighting.*

Production time saved, maintenance time lessened, better work because of correct lighting, 100% salvability of the BullDog equipment—these are a few of the money-saving reasons why the busiest industrial plants in the country are turning more and more to BullDog Universal Trol-E-Duct for really adequate, flexible lighting.

Two other time- and money-saving BullDog Bus Duct Systems

The complete BullDog line of "Plug-in" Flexible Electrical Distribution Systems includes two other time and money savers. BullDog BUStribution DUCT, *for power,* takes power right to the individual machines and permits tapping off as simply and easily as "plugging-in" a household electrical device. BullDog Industrial Trol-E-Duct, *for production lines and assembly benches,* furnishes mobile power and support for portable tools.

To learn how to have ready light and power *wherever and whenever needed,* write for complete illustrated bulletins on BullDog "Plug-in" Bus Duct Systems. Better yet, ask for a call from a BullDog Sales Engineer—and ask him to show you the roster of hundreds of armament plants equipped with one, two or all three BullDog Systems.

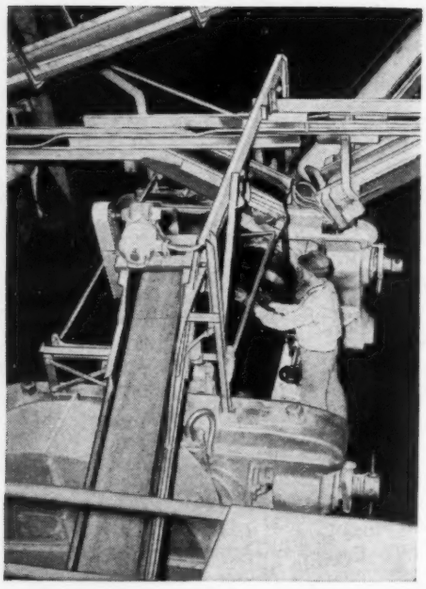
BULLDOG
ELECTRIC PRODUCTS CO.
DETROIT, MICHIGAN
BullDog Electric Products of Canada, Ltd., Toronto, Ontario

MANUFACTURERS OF Vacu-Break Safety Switches, SafToFuse Panelboards, Circuit Master Breakers, Switchboards, Bus Duct Systems—FOR LIGHT AND POWER

STANDARD CONVEYORS

SMASH BOTTLE-NECKS

. . . KEEP WORKING AREAS CLEAR FOR PRODUCTION



STANDARD CONVEYORS keep materials and parts moving — fast and sure — in confined, well-planned channels; they end the sprawling and spreading which hamper men and machines—the congestion that so frequently has one department waiting for the flow of materials from another department—the loss of valuable productive time.

Standard Conveyor engineers have helped hundreds of manufacturers to keep production flowing — to utilize every square foot of working space more effectively — to save time and costs in handling.

What Standard Has Done For Other Manufacturers:

The Standard booklet (FM-3) "Conveyors by Standard" is an interesting presentation showing conveyor applications and possibilities in a wide range of industries. Write for a copy.

STANDARD CONVEYOR COMPANY

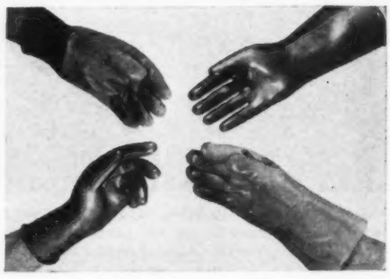
General Offices: North St. Paul, Minn.

Sales and Engineering Service in Principal Cities

that there is no chance of causing a violent explosion of molten metal such as a straight stream or coarse spray would produce, if directed at an incendiary bomb. Safely accelerates burning, bringing about consumption in a few minutes. No special skill is needed. Starts generating "waterfog" as soon as turned on. Operator is using a familiar extinguishing agent, has no fear of running out of it at the crucial moment. Rockwood Sprinkler Co., Worcester, Mass.

Plastic Gloves

Sureseal industrial gloves are produced from a synthetic plastic material that has sufficient elasticity to give flexibility and finger freedom. The transparent material is also applied as a bonded coating to various styles of fabric and leather work-



gloves and is available in aprons and fingercots. Material is inert, non-toxic, odorless, and tasteless. Aging, sunlight, ultraviolet light, acids, alkalies, alcohols, ketones, esters, aromatic hydrocarbons, alipatic hydrocarbons, and mineral, animal and vegetable oils have little or no effect. Resistance to abrasion and tearing is good. The Surety Rubber Co., Carrollton, Ohio.

Adjustable Air Diffuser

Besides diffusing large volumes of air at high velocities and equalizing room temperatures, a feature claimed for the Dorex Kno-Draft ceiling diffuser is its adjustability. Inner cone assembly may be raised or lowered to vary air direction from vertical to horizontal. In cooling systems, the inner cone assembly is lowered to obtain a horizontal air flow, as cool air has a tendency to drop. In heating systems, it is raised for a vertical air flow, forcing downward the warm air that has a tendency to stratify at the ceiling. This adjust-

Type NLAB Quicklag Panelboards are available in 15, 20, 25 and 35-ampere branch circuit breaker ratings.

NOW... a lighting and appliance panelboard that "thinks" faster!

The new Westinghouse QUICKLAG Panelboard has what we call "judgment" —good "common sense." Like all Westinghouse "De-ion" lighting panelboards, each breaker can tell the difference between a momentary, harmless overload and a positive short circuit—but the Quicklag reacts to a short circuit **FASTER**!

It's "quick!" When a short circuit occurs, magnetic trip action alone actuates the breaker.

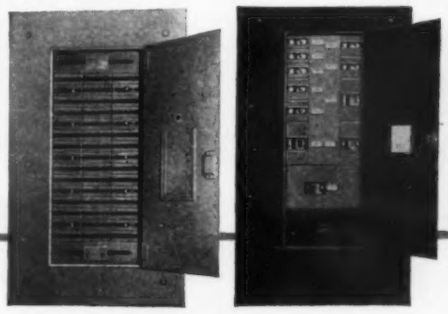
It "lags!" On harmless momentary current overloads, such as motor starting, the Bi-metal protection prevents unnecessary service interruptions. But if the overload continues past a safe point, the circuit is promptly interrupted.

This new Westinghouse development is known as co-operative thermal-magnetic trip action. But when you specify, just say "Quicklag." You'll be assured of maximum protection for lighting and appliance circuits without needless interruptions and resettings. There's a Westinghouse Agent near you. Call on him for help in your circuit protection problems. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-60496

Two other Westinghouse panelboards featuring Type AB "De-ion" breakers are:

LOW-CAPACITY DISTRIBUTION PANELBOARD—designed for low capacity power and lighting applications having branch circuits not exceeding 50 amperes each. For 230-volt A-C systems.

CONVERTIBLE TYPE—for distribution of light and power service, 15 to 600 amperes. For 250-volt systems, A-C or D-C, and 600-volt A-C systems. Permits maximum convertibility.



Westinghouse

NOFUZE CIRCUIT PROTECTION

Speed and more speed is today's battle cry in industry. The *New* Meteor is already piling up daily evidence of its ability to increase output. Such CM features as true balance, streamlined design, aeroplane type cooling, helical gears, precision bearings and one point lubrication give undermanned and overworked departments a new *lift* when they adopt the fast, heavy-duty CM Meteor for handling materials. The CM Meteor can be supplied with hook or I-beam trolley, (push type, geared or motor driven) suspension or trolleys suitable for any special monorail track.

Completely illustrated engineering Catalog No. 142 in color, showing details, specifications, applications and point by point advantages of the CM Meteor will be sent on request. Write:

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(Division of Columbus-McKinnon Chain Corp.)

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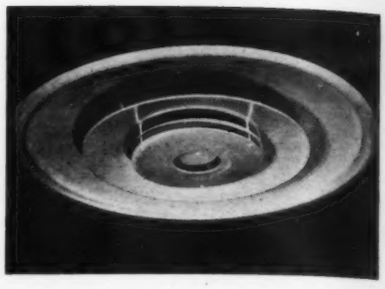


able feature frequently means that the units may be regulated to suit individual job conditions and may be obtained in a unit combining diffused supply air and return or exhaust in one terminal. Also available with built-in direct or indirect lighting. Dorex Division, W. B. Connor Engineering Corp., 114 East 32nd Street, New York.

Strainers

Series of strainers for pipe sizes from 1 to 6 inches, known as "Ezy-Kleen," are suited to applications with all types of pumps, or wherever a strainer is required in a piping layout. Basic design follows that of the standard "basket type strainer." The bodies are made of iron as standard, and are available in bronze. Steam-jacketed bodies can also be furnished. Baskets are made of steel or brass women wire cloth in fine, medium, or coarse mesh, and are

well reinforced. A convenient handle is provided for removing the basket from the strainer body for cleaning.

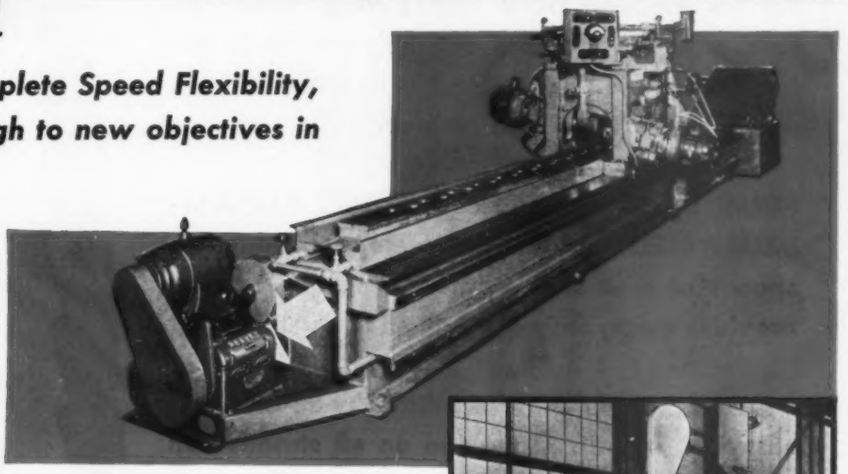
Strainers are rated on a basis of flow in gpm. and are furnished in 5 sizes from 50 to 700 gpm. The 50-gpm. strainer has tapped connections; larger sizes have flanged connections. Standard constructions are suitable for operating pressures up to 50 psi. and for temperatures up to 275 degrees Fahrenheit. Strainers for higher pressures and temperature can be furnished on special order. Blackmer Pump Co., Grand Rapids, Mich.

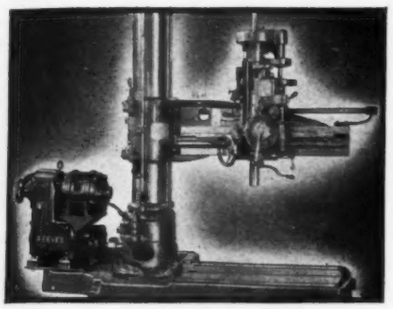
Generating Plant

Mobile generating plants are complete central station powerhouses on wheels, and can be readily transported for instant

SPEED OF A *Machine* MAY BE AS IMPORTANT AS THE SPEED OF A *Tank!*

● ***When a machine has Complete Speed Flexibility, you can quickly break through to new objectives in defense production . . .***





DRILL PRESS EQUIPPED WITH REEVES MOTODRIVE

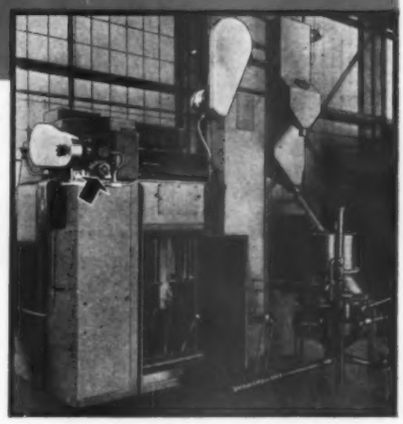
Size of drill, gauge and hardness of metal —*all* influence the speed at which a drill press should be operated, for best results. Presses with inadequate speed control are obviously limited in capacity and variety of work. On the other hand, the radial drill press as shown above, rebuilt by the Louis E. Emerman Co., Chicago, and equipped with a REEVES Vari-Speed Motodrive, is so versatile and flexible it is running continuously in a big armament plant. The "switch over" from one job to another is effected merely by turning a handwheel. The exact speed is so easily attained that REEVES-equipped machines are widely preferred by management and operators.

CUTS TIME FROM 60 HOURS TO 42 MINUTES

This spar milling machine (above) with REEVES Transmission and Electric Remote Control, built by Farnham Manufacturing Co., Buffalo, N. Y., now does in 42 minutes work that used to require 60 hours. On each spar milled, the section varies from end to end. By means of the REEVES Transmission the feed can be adjusted to conform to the various sections and optimum results can be obtained at all points, gradually and without stopping the machine. On high speed milling any jerk in the feed damages the cutters, which run at 3500 r.p.m. with feeds up to 240 inches per minute.

NEW RECORDS SET IN CLEANING SHELLS

Munition shells are blasted with abrasives



to clean thoroughly exterior and interior surfaces and, naturally, the speed of the conveyor carrying the shells through the machine must be accurately timed for different shell sizes. This new American Foundry Equipment Shell Blasting Machine is accordingly equipped with a REEVES Vari-Speed Motor Pulley which provides any speed desired and new records for fast processing. No changing of gears, belts, or pulleys is necessary.

★ ★ ★

NEED HELP? This company maintains a nation-wide staff of factory-trained speed control engineers, located in strategic industrial centers. Their advice and counsel is offered, without obligation, to help speed our defense program. Write, wire or phone REEVES PULLEY CO., Columbus, Indiana.

REEVES PULLEY COMPANY

Recognized Leaders in the Specialized Field of Speed Control Engineering

COLUMBUS, INDIANA

REEVES *Accurate Positive* SPEED CONTROL

How VEELOS V-Belt Can Help Win the War!

Here are 3 ways the exclusive link construction of Veelos V-Belt speeds production for victory!

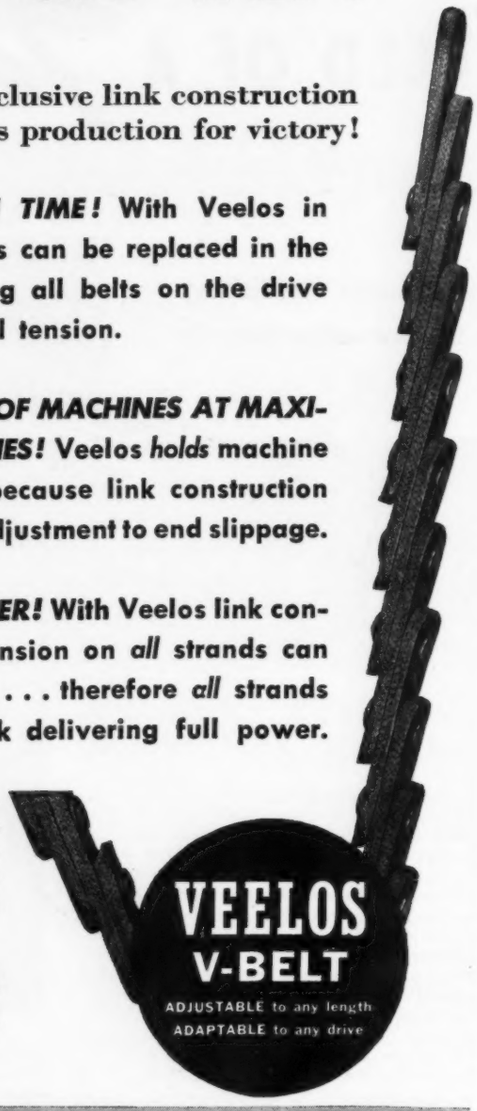
1 ***SAVES PRODUCTION TIME!*** **With Veelos in rolls, strands of Veelos can be replaced in the bat of an eye, keeping all belts on the drive and maintaining equal tension.**

2 ***PERMITS OPERATION OF MACHINES AT MAXIMUM RATED CAPACITIES!*** **Veelos *holds* machine speeds at maximum because link construction provides quick, easy adjustment to end slippage.**

3 ***DELIVERS MORE POWER!*** **With Veelos link construction, equalized tension on *all* strands can readily be maintained . . . therefore *all* strands are constantly at work delivering full power.**

Let a Veelos sales engineer—especially trained in power transmission work—tell you the complete story of Veelos—the only V-Belt that offers the advantages of link construction.

MANHEIM MANUFACTURING & BELTING CO., MANHEIM, PA.

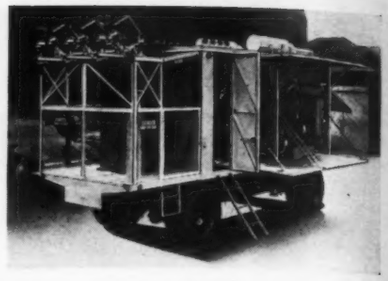


✓ CHECK!

Find out how you can end slippage and stretch with the belt that has more powerful grip and greater resilience . . . **OCTOPUS FLAT TRANSMISSION BELTING.** *No priorities!*

✓✓ DOUBLE CHECK!

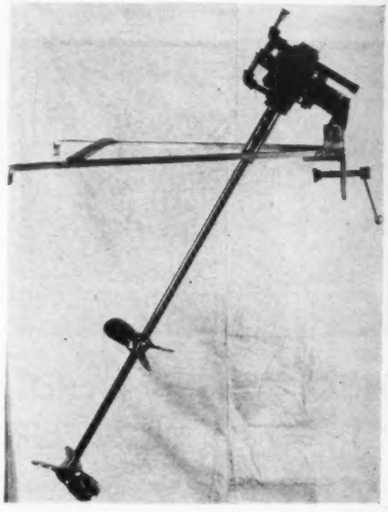
And find out about the conveyor and elevator belt that's delivered in a week or less . . . **KEYSTONE CANVAS STITCHED BELTING.**



power generation whenever needed. Each unit carries two 50-kw. Ready-Power-International diesel engined electric plants, a switchboard, fuel-oil storage tank, electric fuel transfer pump, lubricating oil rectifier, starting batteries, station transformer and both a.c. and d.c. station lighting system, and, also a substation with transformer, lightning arrestors, air break switches. The Ready Power Co., Detroit.

Bracket for Mixer

Two V-shaped brackets to hold the company's direct-drive air-motored agitators are announced. These brackets are made to



fit 30- and 50-gal. drums. A screw clamp at the side of the bracket allows for variations in the drums and insures steadiness of the agitator. Mixer can be adjusted to any angle. The Eclipse Air Brush Co., 400 Park Ave., Newark, N. J.

Protected Steel Sheet

Although zinc is obtainable in quantity, its use at present is such that it cannot be readily secured. To overcome this condition, Protected Steel Products Company, Pittsburgh, has developed an asphalt protected steel sheet for roofing and siding in industrial construction. This product, known as A-P-S, is uniformly coated on both sides with a special composition coating, which, its makers claim, gives it durability and protection against weather conditions, as well as against acid fumes and acid gases.

Can be used for the erection of new plants and for the quick remodeling of old structures. A-P-S roofing and siding will be distributed nationally by Levinson Steel Sales Co., 33 Pride St., Pittsburgh.

BIG JOB On machine tools vital to America's war effort, Tri-Clad motors are well guarded against falling metal chips or dripping coolants by their own sturdy, cast-iron frame and end shields.

DIRTY JOB Note how dust and fumes have coated this Tri-Clad ball-bearing motor. While this is service for which we do not recommend open motors, such as that shown, we are glad to chalk up this instance of motor stamina under severe operating conditions.

TODAY'S TOUGH JOBS CALL FOR TRI-CLAD MOTORS

REG. U.S. PAT. OFF.

NOW more than ever, you must be sure that your motors give you 24-hour operation, even on the *toughest* jobs. Here's where Tri-Clad motors can be a real asset—their *extra protection* features* give them the stamina necessary to keep your equipment in operation in spite of adverse operating conditions.

The Tri-Clad motor's cast-iron frame and end shields are a safeguard against accidental blows—they shield the motor from falling objects and dripping liquids. The stator winding, of Formex wire, is proof against damage from oil, moisture, and heat shock. Improved bearings are easily lubricated, and are sealed against the entry of dust or dirt by complete enclosure in cast iron.

All in all, these protection features are sound assurance of an *extra tough* motor for use on equipment that can't be allowed to quit on the job. Ask your G-E representative for details on types and sizes now available, or write General Electric, Schenectady, N. Y.

*Extra protection against physical damage, electrical breakdown, and operating wear and tear.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

750-112-8058

SLY DUST CONTROL

COLLECTS THE *Invisible Dust*

OFFERS *Greater* FILTERING CAPACITY

Sly Dust Filter for the General American Transportation Co., Sharon, Pa.

★ It's not only the dust you see but the dust you do *not* see that does the harm. Even this fine, penetrating dust—*invisible to the naked eye*—is caught by Sly *Cloth* Filters. (Only cloth can do this job.)

These cloth filters consist of flat bags held under tension (patented) to keep them taut insuring minimum resistance to air flow and *complete* dust removal. The cloth is of high-grade, long-fibre cotton, woven to our special specifications.

Furthermore, Sly uses more filter cloth, hence gives you a filtering capacity greater per sq. ft. of floor space than any other filter on the market. A very important factor in these days of speeded-up production.

As specialists in dust control we shall be glad to analyze your problem. Write us fully, please, so that we can give you complete information.

More than 5,000 in successful operation.

THE W. W. SLY MANUFACTURING CO.

4755 Train Avenue ★ Cleveland, Ohio

SLY
INDUSTRIAL DUST CONTROL

War Industries Face New Hazards

(*Continued from page 72*)

the fuselage. In one plant a serious explosion took place.

In shell-loading plants, dermatitis caused by handling TNT can be a real hazard. This explosive is a skin irritant as well as a systemic poison. Dermatitis resulting from it is characterized by erythema, papules, and vesicles, usually at the bend of the elbow, wrists, belt and collar lines, and knees. It is more likely to occur during the summer months when workers perspire freely. And it is a good idea to lay off alcoholic drinks while one is on a shell-loading job. For a couple of reasons, as a matter of fact.

Prevention of dermatitis from TNT is primarily a matter of keeping skin exposure to a minimum. A weak solution of sodium bisulfite for removing the stains on the hands is recommended.

Watch the Welding

Another hazard that defense production has increased shows up in the handling of metallic sheets and the like, where welding is so important. It is essential in the building of ships and all types of vehicles and airplanes. There are records of accidents and fatalities with men welding in tanks that were poorly ventilated. It seems that no good safety engineers would permit a man to work in a tank without an operator on top with a lifeline, but here is a procedure to watch.

In the shipbuilding industries, electric welding has come into wide use and one of the new problems is to protect other workers from the arc. This is best done with the portable shield or framework over which canvas can be thrown; and by requiring the use of goggles by all helpers.

Industrial management still sometimes makes the mistake that the voluntary disclosure of an occupational hazard is an admission of guilt that may involve some form of industrial punishment. Actually, the first study of a week's accident record sheet after a government order gets under way, that discloses an unsuspected hazard, ought to start an inquiry for the special information that may be necessary to meet the situation.

Some states now have industrial hygiene divisions, which have been developed and fully staffed to answer the problems of management regarding the health and safety of industrial workers.

If your state does not provide this

KEEP THEM ROLLING WITH JONES

JONES Herringbone Speed Reducers in ratings from 1 to 400 horsepower, and all the other types of Jones Speed Reducers, gears and transmission products are playing their part today in the "all-out" production program.

These are products that are built with old time craftsmanship and once they start rolling they keep on rolling.

If any of our products or engineering service will be helpful to you we shall do our best to render as much assistance as possible. Our Bulletin No. 80 "Jones Drives for Industry" will give you a clear picture of our transmission products and manufacturing facilities. Your request will bring a copy by return mail.

W. A. JONES FOUNDRY & MACHINE CO., 4433 Roosevelt Rd., Chicago

Jones

HERRINGBONE — WORM — SPUR — GEAR SPEED REDUCERS • PULLEYS
CUT AND MOLDED TOOTH GEARS • V-BELT SHEAVES • ANTI-FRICTION
PILLOW BLOCKS • FRICTION CLUTCHES • TRANSMISSION APPLIANCES

"PROGRESS" rewarded

"WHITIN" Spinning Frame equipped with Bijur

● Increased prestige and safer profit margins reward users of *improved* machines . . . Up-to-date plant equipment insures better balance between quantity and quality production. Maximum output necessitates efficient lubrication . . . always. Operation with no disturbing shutdowns . . . correct lubrication with "*metered*" feed to each bearing, while running. Specify "BIJUR-EQUIPPED."

BIJUR LUBRICATING CORPORATION • LONG ISLAND CITY, NEW YORK

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AUTOMATICALLY *Correct* LUBRICATION

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MEMO

CHECK THOSE NEW MACHINE SPECIFICATIONS. THE BEST MAKES HAVE AUTOMATIC LUBRICATION.

1558

consultation service, it may be obtained from the Division of Industrial Hygiene, U. S. Public Health Service, Washington, D. C. Excellent printed matter also is available. A recent publication that should be of special interest to everyone who has the responsibility of looking after men in industry is Special Bulletin No. 3. "Protecting Man Power," issued by the U. S. Department of Labor, Division of Labor Standards. In this 70-page booklet industrialists discuss such subjects as fatigue; heating, ventilation and cooling of work places; industrial health programs for the small plant; illumination; and criteria of industrial health hazards. Single copies of this book are available on request.

Men in uniform are being well cared for. Their food, fun, and exercise are all integral parts of their training, and are being treated as such. Industry, too, is duty-bound to take care of its "soldiers in overalls," without whose work in producing arms the men in uniform are helpless.

Absentee Records

Probably many employers would be shocked if they analyzed their absentee records. They would find out how many absences are of longer than a week's duration—how many man-hours they are losing, and how many days' pay their employees are losing.

I made a brief study of the problem of absenteeism in a group of large industries. One of them, working on a $3,800,000 federal contract, had three workers absent because of injuries received in an "off-the-job" automobile accident, and 277 people absent because of illness, during the first few months of 1941. These absences cost production 1,989 days in that brief period.

Another company, trying to speed up delivery on an $800,000 contract, had ten workers involved in automobile accidents, with the average absence from five to six weeks; and there have been 1,150 cases of lost time because of sickness, with an average loss of from 175 to 200 hours per case.

Both these companies have a better average lost-time rate within the plants. Yet they cannot control the interruption to production caused by the reckless use of public highways; or correct improper food, fatigue, and sanitary conditions in workers' homes.

Because they are well managed, these two companies were able to give me accurate information on this subject. But a considerable number of other firms were frank in telling me that they knew workers are absent because they were in automobile accidents, and there were vacant places because an employee is "out sick," but

a hardship on the man who substitutes.

A major advantage discovered is that the several men in a department in a larger plant, or the several departments of a small plant having only one man per shift at each post, always have the same team of men operating at any one time; and this group of men working always together, build up a better spirit of cooperation than if the group is continually broken up by non-uniform shift changes. Of equal importance is the fact that the supervisor, working only during the daytime, will see every man at least once in four days, while in schedules changing shifts weekly it may be several weeks before a supervisor sees certain men.

Overtime Payments

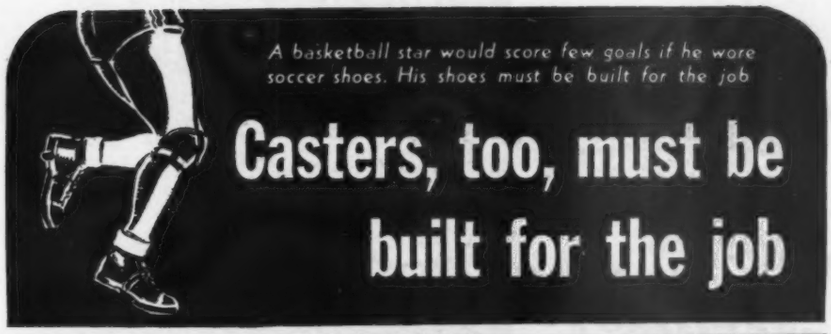
One important consideration is the requirement of the Wage-Hour Law that all time over 40 hours in any week is paid as overtime. Any schedule giving one man less than 40 hours increases the overtime to another, and 8 hours overtime must be paid every week. No matter when this schedule starts every man will work at least five full shifts or 40 hours. In the diagram, A works 6 shifts, or 48 hours, the first week and thus receives all the overtime, while each of his partners works only the regular 40 hours; but one week in four each receives the full 8 hours' overtime. There could be nothing simpler, since a man either works 5 or 6 shifts weekly.

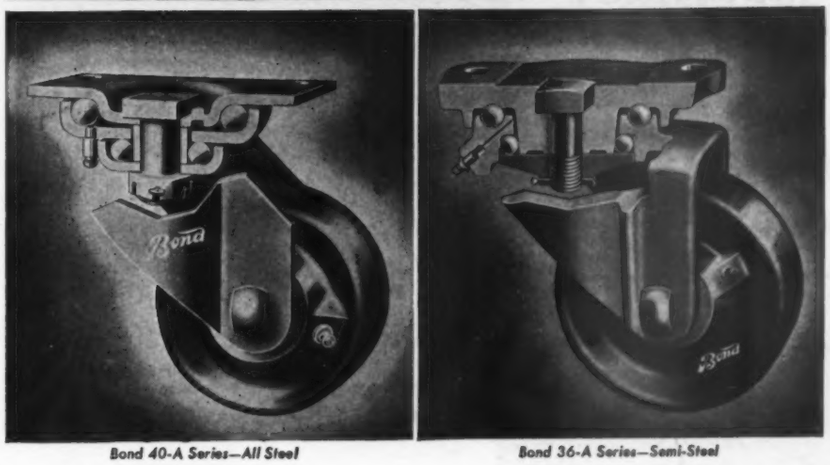
There are no variations of the uniform pattern; but the question "*when does it start*" is important. The diagram indicates the calendar week beginning and ending with a man coming to work and one leaving. If the plant week does not start at Sunday noon, or if the shifts do not start at noon, 8 p.m. and 4 a.m. the program may be moved forward any desired number of hours to give different overtime arrangements (always two weeks without overtime, and the other two weeks dividing 8 hours, as 4-4, 5-3, 6-2, 7-1, or 8-0).

Like Daylight Hours

Gray employees prefer to start at noon, 8 p.m., and 4 a.m., as this always gives them at least half the daylight every day (morning or afternoon) for their own pursuits; and divides up the night in such a way that it is easy to get to sleep. Furthermore, all shift workers can have their noon dinner at home at about the normal time. Also, the day-working supervisors contact two sets of shift workers each day.

The plan was first used in the chemical plant, where one man handles


A basketball star would score few goals if he wore soccer shoes. His shoes must be built for the job
Casters, too, must be built for the job



Bond 40-A Series—All Steel Bond 36-A Series—Semi-Steel

MATERIALS handling must speed up to keep pace with increased production. Rely only on truck casters *built for the job.* Specify Bond for all your trucks . . . and get more in length of service . . . load capacity . . . ease of handling. Bond uses the materials and construction that best fit the *function* of each caster . . . designs ball races to meet specific load, shock and friction requirements. Bond specialization improves every caster from king bolt to tread! Make *exactly* the right choice for your work from the Bond Data Book. Write today for your free copy.

Built-for-the-Job Advantages In Bond Lift Jacks, Too!
For the smoothest possible flow of materials, team Bond Casters with Bond Lift Jacks and Platforms. All models of Bond Lift Jacks are easy to operate . . . all save time. You can install the labor saving Bond Lift Jack-Platform System with a minimum of equipment. Write today for free bulletin.
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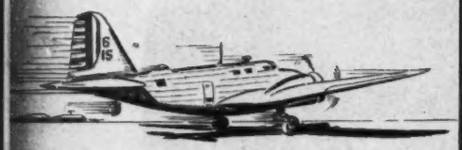
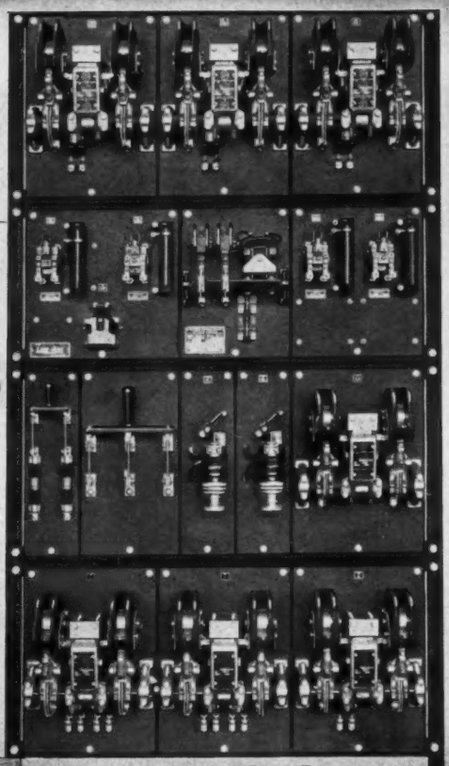
LIFT JACKS
BOND FOUNDRY & MACHINE CO., MANHEIM, PA.



Smooth Acceleration

EC&M FREQUENCY RELAY MAGNETIC CONTROL



60 HP, 440 Volt EC&M Frequency Relay Magnetic Controller for car dumper illustrated below.

End view of Wellman Engineering Co. Rotary Car Dumper recently installed in north-central power generating station.

Car Dumper in extreme dump position. Limit Switches provide slowdown and stop at both limits of travel.

FROM standstill on the runway until the wheels leave the ground, the modern airplane increases in speed uniformly and smoothly over the entire distance required for the take-off.

Likewise, EC&M Frequency Relay Magnetic Control brings a-c wound-rotor motor-driven machines up to speed equally as smoothly and uniformly from the instant power is applied until the motor is running at full speed.

Besides being easy on the motor . . . and easy on the machinery during acceleration, this control can be designed to meet specific torque requirements for certain starting conditions such as encountered in wire drawing. In this instance, proper secondary resistance is chosen to give suitable starting and accelerating torque which will eliminate wire breakage and EC&M Frequency Relay Acceleration matches these pre-selected values to the load for smooth, safe acceleration.

Ask for Literature No. 930 on EC&M Frequency Relay Magnetic Control.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

EC&M Frequency Relay Acceleration matches motor torque to the requirements of the load.

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.

shift and eats his lunch without leaving, and on company time. In some cases it is desirable that he stop his work to eat. By allowing 23 minutes off per shift for lunch, however, a man will average 40 hours a week. A longer lunch period may be worked out to minimize overtime, if the schedule is used wherein a man works 5½ shifts for two consecutive weeks (or really 11 shifts within the two calendar weeks) and then two weeks of 5 shifts each. If the 8 extra hours are divided into rest periods, there are 11 such periods of 43.64 minutes. Streamlining this to a 45-minute lunch period will give 2 work weeks of 39⅞ hours each and 2 work weeks of 36¼ hours each, with no overtime to be paid. The simplest system, with one hour off for lunch, would reduce time to 7 hours of pay for each trick; or 38½ hours for each of 2 weeks, and 35 hours for the other two.

A three-man combination working 9-hours shifts with 1 hour off for lunch and coming back in 18 hours instead of 24, will work a 27-hour cycle instead of 32, which returns to starting point in 9 weeks. It averages a little less than 50 hours a week.

Significant Labor Developments

(*Continued from page 69*)

particular agreements. (NLRB vs. Knoxville Publishing Company.)

3. *To bargain concerning interpretation of contract.* The United States Supreme Court (NLRB vs. Heinz) in interpreting the duties of management under the Wagner Act, held that the duty to bargain requires a willingness to reduce the agreement to writing. In further amplification of the employer's duty, the Circuit Court of Appeals now holds that the duty to bargain also includes the duty to bargain over the interpretation of the agreement. An employer's refusal to confer on the contract's meaning is therefore an unfair labor practice, according to this Circuit Court ruling. (Rapid Roller Company vs. NLRB.)

Forms of Discrimination Condemned by Labor Board

1. *Closed Shop Contract* — An employer who, after making a closed shop contract with a minority union, announced to strikers that to retain their jobs they must report to work by a certain date and join the union. (Northwestern Cabinet Company.)

BUILT FOR *Use* AND *Abuse*

HALLOWELL

WORK-BENCHES OF STEEL

More than 1300 styles and models to fit every need . . . each one noted for its sturdiness, rigidity, wearing quality and smart appearance . . .

Pat'd. and Pat's. Pend'g.

"Hallowell" Bench tops are famous for their ability to withstand use and abuse. The model shown is fitted with a heavy laminated maple wood top. Steel and Masonite tops are also available.

Throughout industry, the choice of particular buyers is the "Hallowell", because of built-in quality and practical design for every purpose.

Pat'd. and Pat's. Pend'g.

Exclusive is the wide range of widths and heights of leg sizes "Hallowell" Benches provide for varying requirements. Available in standard and extra heavy construction.

BULLETIN AND DETAILS ON REQUEST — NO OBLIGATION

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA. BOX 546

— BRANCHES —

BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO

For Handling

Air

Water

Steam

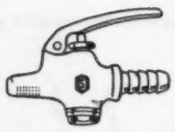
Oil

and

Electricity

AIR NOZZLES

Four popular types of simple dependable construction. Valves permit easy control of air volume.



HIGH PRESSURE COUPLINGS

For heavy duty service on steam, air, or water hose. Impossible for hose to blow off. Size ⅜" to 1".

BARREL FAUCETS

Improved design, extra large capacity. Two types of locking levers. ¾" or 1" I.P.

WATER, STEAM, OIL HOSE COUPLINGS

A wide variety of sizes and styles to meet all requirements.

HOSE CLAMPS

A Sherman specialty. Sizes and styles for all types of service.

FUSIBLE PLUGS

A variety of patterns to meet most specifications. Also approved Marine, A.S.M.E. and A.P.I. plugs. Sizes from ⅜" to 1½".

Sherman Fittings

INDUSTRIAL SHOWER FIXTURES

Sherman Rough Nickel Shower Fixtures are widely used in industrial plants. Made for hard service and furnished in several different styles and combinations. Equipped with cleanable ball joint shower head.

▲ ▲ ▲

Electrical Fittings

SOLDERING LUGS

Types and sizes to meet all needs. Special sizes, lengths, finish, etc., available on order.

SOLDERLESS LUGS

Underwriters approved. Simple and easy to install. Size from 35 amps. to 500m CM.

▼ ▼ ▼

Also - -

SOLDERLESS CONNECTORS

FIXTURE CONNECTORS

SET SCREW CONNECTORS

SPLICING SLEEVES

This company is equipped for volume production of these and many other types of standard fittings, as well as special items of this general nature. Where the need is vital, reasonably prompt deliveries can be made on many of these fittings.

We invite inquiries from concerns who will use this material to aid our country's war efforts.

H. B. SHERMAN MFG. CO.

Battle Creek, Michigan

Write - - for Catalog

Which shows the complete Sherman line of Industrial and Electrical fittings

2. *Coercion — Taking Advantage of Intra-Union Strife* — The employer first opposed the organization of an outside union, but when he later found that the organizer was not approved by other leaders of the union's central organization, he attempted to induce his employees to abandon the organizer and affiliate with the same union through the other leaders. Whereupon the majority of employees withdrew from the union and formed a new local with the organizer as its leader. The Board interpreted the employer's conduct as coercion sufficient to justify a cease and desist order. (Northwestern Cabinet Company.)

3. *Consent to an Election*—An employer who consented to an election but gave pre-election aid to an inside union with the result that the outside union interrupted the campaign by going on strike. (Northwestern Cabinet Company.)

4. *Insubordination*—Discharge for disobeying a rule against union solicitation during work hours is discriminatory, when the rule itself is discriminatorily enforced. (Bersted Manufacturing Company.)

5. *Union Compulsion*—The refusal by members of one union to work with a member of another union does not justify an employer in discharging the employee objected to, unless the objecting union musters such power that the employer's only alternative is to go out of business. The mere threat of a strike is insufficient justification for yielding to the pressure. Reinstatement with back pay is ordered. (Westinghouse Electric & Manufacturing Company.)

Enforcement

1. *Union of "Little Business Men" Not Entitled to Protection of Anti-Injunction Act.* The Supreme Court denied the benefits of the Anti-Injunction Act to a union of "Little Business Men." The union, composed of independent fishermen organized to sell their product to processors, forbade its members to sell fish to packers because of the packers' refusal to agree to buy only from members of the union. The packers sought an injunction on the ground that the union was violating the Sherman Anti-Trust Act. The union insisted that it was protected by the Anti-Injunction Act, on the theory that a labor dispute was involved. The Supreme Court, however, decided that no labor dispute was involved and, therefore, the Anti-Injunction Act had no application to the controversy. Were this a genuine union, the relief sought would have been granted.

Airplane Engine Parts accurately honed to a super-smooth finish.

Aluminum Aircraft Link "produces high finish without bell-mouthing."

Gyroscope Balance Valve Body "saves production time in getting closer limits of accuracy."

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

Aircraft Valve Tappet Roller—.0003" stock removal to produce highly polished surface.

Inner Bearing Ring "Accurately removes last 'tenth' of stock."

"A perfectly straight round hole with a mirror finish."

Drawing and Blanking Die "Saves time in producing smooth base metal finish."

Drill Jig Bushing "Increases sales appeal of product."

"Produced an extremely accurate and glass-like finish."

Sheffield Corporation

of Dayton, Ohio

Master Gagemakers —

—uses the Sunnen MA Precision Hone to remove .015" from the carburized surface of a .372" diameter hole 3½" long in a Gaging Spindle. Machine is also used on cylindrical rings.

Time saved over previous method — 50%.

Solve your problems of accurately finishing internal cylindrical surfaces with the SUNNEN Precision HONING MACHINE

● Sheffield says Sunnen cuts time 50%. Other manufacturers handling important new orders report similar production increases. By using the Sunnen Precision Honing Machine to accurately grind and finish internal cylindrical surfaces from .185" to 2.400", many manufacturers have been able to release heavy internal grinders for other work. These manufacturers have been amazed to find that such an inexpensive piece of equipment can produce such accurate work. Accuracy is guaranteed to within .0001", and has often been held to within .000025" in production work.

Skilled or experienced operators are not required. Any intelligent workman can produce precision workmanship with only a few hours' practice. You can shift your highly skilled labor to other jobs.

Saves set-up time—the Sunnen Precision Honing Machine can be set up and work located ready for honing in less than one minute.

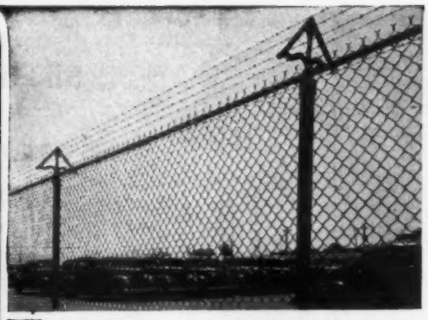
Write for FREE *8-page Bulletin*

This new bulletin will give you complete information—or if you prefer, a Sales Engineer will be glad to call with his demonstrator and show you what this machine can do for you on your job.

SUNNEN

SUNNEN PRODUCTS CO. 7938 Manchester Ave., St. Louis, Mo. • Canadian Factory: Chatham, Ont.

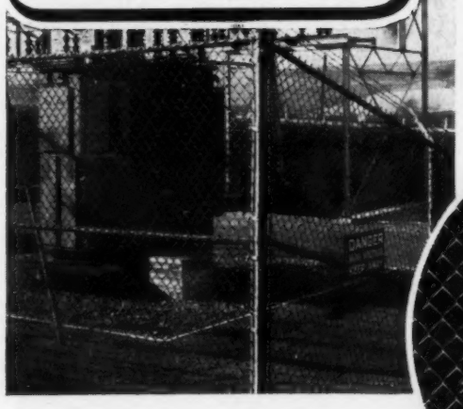
First choice for the defense of America's busy plants



The parking lot is an important part of the modern plant. Fence protects workers' cars from thievery—helps watchmen maintain complete control of all entrance and exit.

Power is too important to risk intentional or careless damage. Transmission lines, transformers and generating stations by the hundreds are guarded by Cyclone Fence.

Industry must be careful who is allowed in plants doing defense work. Cyclone Fence forces all traffic through closely guarded gates. Management can demand credentials from every person who enters the plant—can check on every piece of material taken out.



Oil must flow uninterrupted to America's Army, Navy, factories, trucks and autos. Many miles of Cyclone Fence have been built to protect refineries and pipe lines.

MORE plant owners choose Cyclone Fence than any other property protection fence. And for good reasons. Plant owners know that Cyclone's rugged construction can be relied upon for better protection. And it means less upkeep, longer life and lower fence costs. So quite naturally, when plans, blueprints and dies for defense production must be so closely guarded, they turn to Cyclone for fence.

Right now, our own factory-trained erection crews are building fences for plants all over the country. This work is being speeded as much as possible in order to help industry protect its valuable property and guard defense secrets. Always important—this protection is today an essential part of the defense production job.

CYCLONE FENCE DIVISION
(AMERICAN STEEL & WIRE COMPANY)
Waukegan, Ill. · Branches in Principal Cities
United States Steel Export Company, New York

USS **CYCLONE FENCE**

UNITED STATES STEEL

32-Page Book on Fence

Send for our free book on fence. Crammed full of facts, specifications and illustrations. Shows 14 types—for home, school, playground, and business. Buy no fence until you see what Cyclone has to offer.

CYCLONE FENCE
Waukegan, Ill., DEPT. 932
Please mail me, without obligation, a copy of "Your Fence—How to Choose It—How to Use It." I am interested in fencing: ☐ Industrial; ☐ Estate; ☐ Residence; ☐ School.
Approximately _____ feet.
Name _____
Address _____
City _____ State _____

2. *Suit to Stop NLRB Election by Court Injunction Fails.* The District Court for the District of Columbia ruled that no injunction may issue in the absence of clearly unlawful action by the Board which would bring irreparable injury to the employer. In denying an injunction to prevent the Labor Board from conducting an employee election, the court rejected the claim of the employer that employees will become suspicious, their efficiency impaired, and public confidence undermined. (Marshall Field & Company.)

3. *Court Finds NLRB Order in Conflict with Motor Carrier Act.* The Circuit Court of Appeals at Cincinnati refused to enforce an order for reinstatement of employees on the ground that their reinstatement would violate the Motor Carrier Act and regulations issued under it. The employer, a motor truck firm, claimed the discharges were for drunkenness. The Board had found, however, that alleged drunkenness was not the actual motive. The Court held that the Interstate Commerce Commission has laid down rules pursuant to the Motor Carrier Act, prohibiting any carrier to permit an employee to drive a truck who is intoxicated while on duty or who makes excessive use of intoxicating liquor. In view of this rule, the court concluded that the Board's order of reinstatement violated public policy and was contrary to law. (NLRB vs. U. S. Truck Company.)

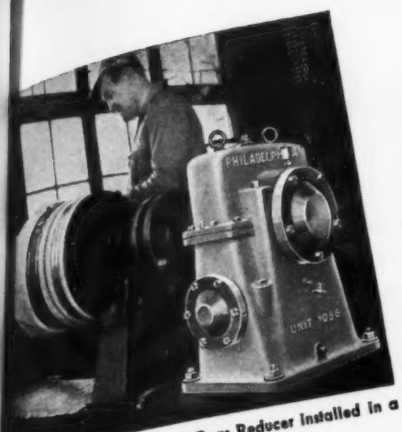
WAR LABOR BOARD

War Labor Board to Act Only on Otherwise Unsolvable Disputes

The Board has decided to act only for the "final determination" of disputes "which cannot be settled by mediation or voluntary arbitration." The task of mediation is delegated to associate board members, representing industry, labor, and the public.

War Labor Board Procedure

The Board's order of settlement is mediation by tripartite panels designated by the chairman from associate members to be appointed, on which panel the representatives of employers and employees will be equal. If mediation fails, arbitration will be urged. Should this not work, a report is to be made to the Board by the mediator setting forth findings of fact and recommendations for settlement of the dispute; the case is thus transferred to the Board. The Board may approve the findings and recommendations of the mediator. It may require further investigation of facts and accordingly recommend to the chairman



A Type AT, Horizontal Worm Gear Reducer installed in a Motor Repair Shop.

Type 2 HB, Double Herringbone Reducer installed in a grain elevator.

A Type HD, Horizontal MotoReduceR driving a screw conveyor in a refractories plant.

"ONLY A COMPLETE LINE OF SPEED REDUCERS CAN MEET ALL DRIVE REQUIREMENTS... SO WE MAKE ALL TYPES"

The many different operating conditions encountered in industry make it essential that the right type of speed reducer be chosen, if economical and efficient performance is to result. But . . . the right type can only be provided when there is a complete line available. Because of this Philadelphia, has for years made all types of speed reducers in a wide range of ratios and horsepowers. Also, there is the Philadelphia MotoReduceR in horizontal and vertical types for use where a complete drive unit is desired. Our engineers are specialists in helping you choose the best drive for your needs. Call on them . . . write today.

PHILADELPHIA GEAR WORKS

INDUSTRIAL GEARS
AND SPEED REDUCERS
LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET
PHILADELPHIA, PA.
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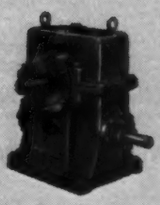
Philadelphia
LIMITORQUE CONTROL
operates all types of valves, etc., safely, economically, from convenient stations.

Philadelphia
GEARS
All types and sizes of industrial gears. Can be supplied in all materials.



Philadelphia
WORM GEAR SPEED REDUCER
right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

Philadelphia
MOTOREDUCER
The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.

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HERRINGBONE SPEED REDUCER
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

HANSEN *Push-Tite*
AIR HOSE COUPLING

The call today is for speed and more speed to keep 'em flying and rollin' and that's why you will find Hansen *Push-Tite* air hose couplings right in the thick of the war production fight, being used extensively by the Army, Navy, aviation and industrial plants throughout the country.

Hansen Push-Tite air hose couplings are rugged, fast, economical, easy to operate and trouble proof. A slight push of the plug into socket... it's connected absolutely airtight and the air is automatically turned on, a gentle pull ...it's disconnected and air is instantly turned off. None of the customary twisting or turning of parts in order to connect or disconnect and the coupling's complete swiveling action prevents kinking or twisting of hose.

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INDUSTRIAL *Air Line* EQUIPMENT
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that an investigator or examiner be designated to make such investigation and report to the Board. Or, finally, it may wish the parties to appear before it.

Precedents Carried Over From Mediation Board

Although the Defense Mediation Board passed into history when the President superseded it by the War Labor Board, the continuity of its policies and procedures appears assured. This conclusion is fortified by the fact that a large proportion of the members of the old Board are among the members of the new Board, and the Board, like its predecessor, must base its settlements, in the main, on agreements and approved custom.

1. Agreement is the most effective form of regulation.
2. Bargaining agencies are entitled to protection from hostile employers and from rival unions seeking to undermine them.
3. The all-union shop should be granted only in very special circumstances in abeyance of agreement.
4. Wage disputes should be settled on the basis of competitive conditions and ability to pay.

What May Be Expected

District Judge Charles E. Wyzanski, member of the old Defense Mediation Board, discussing the War Labor Board in an address at Northwestern University, noted as specific results which may be expected:

1. The adoption of a technique of appointing special investigators for individual situations in determining wage policy.
2. Compulsory arbitration as a necessary accompaniment of a no-strike agreement.

Five War Board Settlements Involving Demands For All-Union Shop

Negotiated settlements in five cases before the War Labor Board, although involving no decision by the Board, indicate how the controverted issue of the all-union shop is handled by conferees sitting in the presence of mediators who have been vested with coercive powers. In each case the union settled for less than the full all-union shop, a fact which is significant in that all the cases involved CIO unions and CIO itself handled the cases for its affiliates. In three instances, maintenance-of-membership clauses with graded variations were accepted. Assurance of company favor toward union membership was accepted in one case. In the fifth, a wage increase was taken as an alternative, the union getting a contract which it had wanted for 3½ years.

Controlled by a . . .

COLT MAGNETIC STARTER

Illustrated is a Colt Magnetic Starter and a Colt Push Button Station.

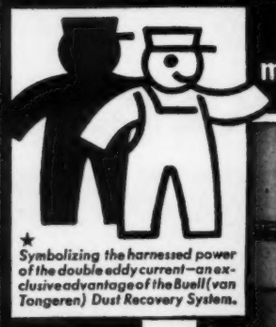
Designed and built to help maintain today's 24-hour industrial activity . . .

- Straight line vertical operation.
- 3-point ball bearing armature guides.
- Double break pure silver contacts.
- Non-carbonizing molded contact block.
- Thermal overload relays with instant choice of hand or automatic resetting.
- Available in many forms—with local, remote, and transfer switch control.

COLT'S PATENT FIRE ARMS MFG. COMPANY
ELECTRICAL DIVISION HARTFORD, CONN.
106th YEAR OF PRECISION MANUFACTURING

"Double Eddy" says:

The buyer wanted to know how much dust this collector would recover



★ Symbolizing the harnessed power of the double eddy current—an exclusive advantage of the Buell (van Tongeren) Dust Recovery System.

Installation of Buell Collectors in plant of nationally-known food products manufacturer.

BUELL GAVE THE MOST ACCURATE GUARANTEE KNOWN

Buell's "fractional efficiency" guarantees are famous for their accuracy. Briefly, they are guarantees to collect a definite percentage of the dust particles of each size—a guarantee that holds regardless of the inevitable and continual changes in particle size distribution that make it impossible ever to give an unqualified overall efficiency guarantee. Buell's guarantees are conservative and actual performance usually betters the guarantee.

For a typical installation, here are guarantees and actual performance:

Particle* Size in Microns	Guaranteed to Collect	Actual Collection
0 to 10	61%	63.2%
10 to 20	92%	92.6%
20 to 30	98%	98.5%
30 to 43	99%	99.4%
plus 43	99.5%	99.8%

*Specific Gravity—2.0

May we send you a copy of our special bulletin *"Fractional vs. Overall Efficiency Guarantees"?* Simply request it on your letterhead.

BUELL'S 6 PLUSES

Buell (van Tongeren) Dust Recovery Systems offer every user these six plus advantages . . .

+ *High Recovery Efficiency*
+ *Low First Cost*
+ *Low Maintenance*
+ *Unlimited Capacity*
+ *Long Life*
+ *Fractional Efficiency Performance Guarantees*

. . . all good reasons why so many of America's leading industrial concerns prefer Buell.

BUELL ENGINEERING CO., Inc.
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Nation-wide service through offices of either Buell Engineering Co. or B. F. Sturtevant Co.

CONSULT BUELL *First* IN DUST RECOVERY

for Chemical • Rock Product • Metallic • Food • Flue or any other dusts

buell DUST RECOVERY SYSTEMS

How Subcontracting Can Be Made to Work

(*Continued from page 60*)

available, so the same figure still rolls glibly from the tongues of professional big business baiters. It was based on an OPM analysis of some $9,800,000,000 in contracts, and it is probably misleading today for it takes no account of the countless small companies that eventually shared in the business as subcontractors working either for the 56 top firms or for the 6,000 other prime contractors who split the remaining 25 percent.

Yet no friend of industry will pretend for a moment that the big companies have done all they can to spread the work. On the contrary, those closest to management are clearest in their criticism of many of our biggest firms for failure to go aggressively after new sources. And virtually without exception, the men to whom FACTORY talked have put the work-spreading job squarely up to industry *henceforth.* Yet they all concede that big industry has been meeting the schedules set for it by government and they agree equally that small industry during the whole pre-war period made little serious effort to get defense work.

If, indeed, the whole success of the war effort depends primarily on industry's own initiative in subcontracting, industry will overlook no bets to make sure that it does its part. What, then, are the specific things that industry must do?

Rule 1. Every company, big or little, should have a competent, active subcontracting department. If a company consists of two men, one of them should be a subcontracting specialist.

Rule 2 (for big companies). The subcontracting department is not to be considered as an executive stepchild but as a major operating branch with a definite assignment and every necessary authority, as well as personnel, to accomplish its task.

Rule 3. The function of the prime contractor's subcontracting department shall be:

1. To assemble a competent staff for negotiation and inspection.

2. To assemble complete data on sources through liaison with WPB (Contract Distribution Branch), field procurement officers of the armed services, industrial associations, Cham-

YALE PUMPS IMPROVE

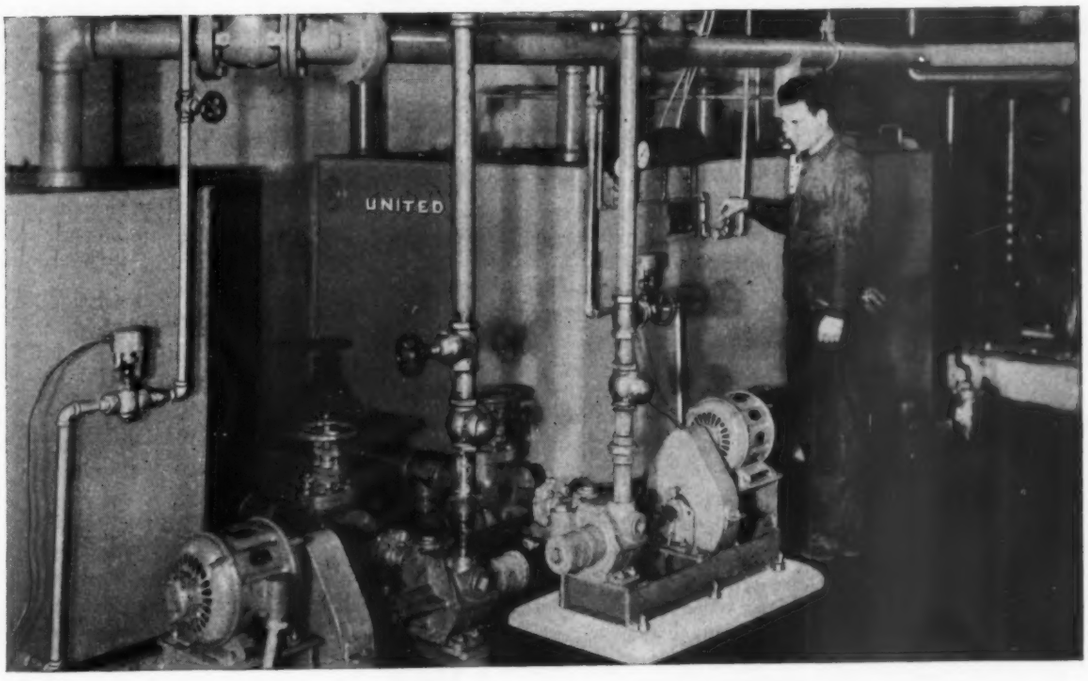
Oil Circulation at Follansbee Steel

End Oil Breakdown Thru Agitation, Heat or Foaming . . .
Eliminate Safety Valves or Air-Balanced Pressure Tanks . . .
Avoid Pressure Build-ups . . .
Gain Economy of Installation, Operation and Maintenance . . .

★

★

★



CONSTANT but adjustable oil pressure, with automatic variable volume control, is obtained by the Follansbee Steel Corp., West Virginia plant, by installing Yale & Towne's rotary variable control pumps in circulating oil systems for back-up roll bearings.

The amount of oil pumped is the exact amount of oil passed through the bearings, which varies with the speed of the mill. As a result, by-pass relief is eliminated, together with safety valves or air-balanced pressure tanks. Shut-off valves anywhere in the system may be closed while the pumps are working, without any pressure build-up. Complete shut-off results in maintained pressure, with no flow; *for no more oil enters the pump than the amount for which outlet flow is open.*

Simple in construction, with only two pumping members, three moving parts, these pumps are adaptable to varying viscosities without change of fit of pumping members. Variable volume and manual flow control features make them ideal for liquids requiring careful or specialized handling.

TRADE **YALE** MARK

THE YALE & TOWNE MANUFACTURING COMPANY
212 Henry Street
Stamford, Connecticut, U. S. A.

Only this all-out scale of production will hasten the ultimate all-out victory. Speed will count. . . . Speed will save lives, speed will save our freedom and our civilization, and slowness has never been an American characteristic.

— From President Roosevelt's Message to Congress.

WILL YOU GIVE A FEW MINUTES OF YOUR TIME TO STUDY NEW METHODS TO SPEED PRODUCTION?

WORKING closely with the production men of practically every industry, Turco Service Engineers and our Research Laboratory have learned the fastest and best ways to handle *all types of industrial cleaning*. These short cuts to more efficient, greater-volume production are available to *you*.

You can give your firm top perfection in industrial cleaning—and have the personal satisfaction of knowing that the few extra minutes you take to study new operation methods will be productive of greater volume and a bigger war effort.

BRAINS WILL WIN THE WAR! Check which operations listed below interest you, mail to us immediately, and we'll see that you get this important information—speedily.

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COMPOUNDS FOR EVERY CLEANING OPERATION IN EVERY INDUSTRY

TURCO PRODUCTS, INC., 6135 S. Central Ave., Los Angeles

Gentlemen: A32

Please send me FREE literature on materials, methods and procedure pertaining to the operations checked below:

MY NAME IS:_____

FIRM NAME AND POSITION:_____

ADDRESS_____

CITY AND STATE_____

I'M INTERESTED IN THE OPERATIONS WHICH I HAVE CHECKED (✓):

- ☐ ACID PICKLING
- ☐ ALUMINUM SPOT WELDING
- ☐ ANODIZING
- ☐ AUTOMOTIVE MAINTENANCE
- ☐ CADMIUM PLATING
- ☐ CHEMICAL VAPOR CLEANING
- ☐ CHROMATIZING
- ☐ CLEANING HEAT EXCHANGERS
- ☐ CLEANING METALS BEFORE PROCESSING
- ☐ CLEANING PRIOR TO PLATING
- ☐ COLD IMMERSION CLEANING
- ☐ COLD SPRAY CLEANING
- ☐ DISHWASHING
- ☐ ENGINE CLEANING
- ☐ FLOOR MAINTENANCE
- ☐ GENERAL PLANT MAINTENANCE
- ☐ GLASS CLEANING
- ☐ HOT IMMERSION CLEANING
- ☐ LAUNDERING
- ☐ MAGNESIUM PROCESSING
- ☐ PAINT CAMOUFLAGE CLEANING
- ☐ PAINT DEPARTMENT MAINTENANCE
- ☐ PAINT STRIPPING
- ☐ PASSIVATION OF METAL SURFACES BEFORE PAINTING
- ☐ PHOSPHATIZING
- ☐ RADIATOR AND COOLING SYSTEM MAINTENANCE
- ☐ SCALE REMOVAL AND CONTROL
- ☐ STAINLESS STEEL PROCESSING
- ☐ STEAM BOILER MAINTENANCE

bers of Commerce, and the like; through representation at clinics; through advertising, if necessary; and through friendly reception offices and interviewers at the plant.

3. To see that the hardest jobs are retained in the plant and the easiest jobs made available to subcontractors at prices that allow a fair profit.

4. To see the job through at the subcontractor's plant, to supply him with materials, jigs, fixtures, operation layouts, time study data, and, if need be, tools.

(It is assumed that the prime company has also a sales department specializing on government business, with which the subcontracting department maintains close contact.)

Rule 4. The function of the subcontractor's business-getting department shall be:

1. To visualize its job as a fight for individual and national survival, to realize the cruel truth that *nobody* in the government (except a handful of Congressmen) cares anything about the preservation of "small business" as an end in itself—except the small business that can and will produce for war.

2. To assemble in multiple complete data, briefly and attractively presented, with photographs if possible, on facilities. These data should include number of employees; number that could be worked on extra shifts; number of shifts now being worked, and length; list of machines by size, type, manufacturer's name and serial number, year built, and tolerances to which they will work; number of machine-hours idle per week at present (broken down by machines); adequacy of power sources, shipping facilities, etc.

3. To establish and maintain contact with nearest office of WPB's Contract Distribution Branch (still listed in most telephone directories under "U. S. Government, National Defense, Office of Production Management, Contract Distribution Division") which is there to help you get in touch with prime contractors and to give you information on bids, priorities, contracts, financing, etc.

4. To do an imaginative, aggressive, and persistent engineering and selling job in pursuit of any business that seems within reach; to figure prices at a fair profit only; to circularize and visit in person the subcontracting de-

YOU'LL FEEL BETTER

when you know that your plant and production are guarded by

SHAWMUT SHUR-LAG RENEWABLE FUSES

because at last you'll be rid of needless shutdowns and delays from inefficient fusing. Nearly half a century of superior engineering skill and manufacturing craftsmanship, devoted exclusively to the making of electrical protective devices, stands behind SHUR-LAG fuses. Now as ever, they are the simplest, sturdiest, most serviceable time-lag fuses you can buy, and the easiest and quickest to renew. Don't take chances, ask your dealer today about SHAWMUT SHUR-LAG FUSES or write for our Bulletin 400.

THE CHASE-SHAWMUT COMPANY
NEWBURYPORT, MASSACHUSETTS

FUSE MAKERS SINCE 1893

GAS PROTECTION on the INDUSTRIAL FRONT

M·S·A EQUIPMENT
FOR EVERY RESPIRATORY HAZARD

Time-proved safeguards, **built by the world's largest manufacturers of approved safety equipment, possessing every refinement for better protection, comfort and service that keep men safe on the job. Let us send you our descriptive Bulletins!**

M. S. A. ALL-SERVICE GAS MASKS

Efficient protection against *all* industrial gases, fumes and smoke—singly or in combinations, including carbon monoxide. All-Vision Facepiece. Built-in Self-Timer.

M. S. A. INDUSTRIAL GAS MASKS

Masks for each individual industrial gas hazard (excepting carbon monoxide and gases containing it), combining specific protection for wearer with long service life

M. S. A. HOSE MASKS

Supply safe outside air through hose to mask wearers in confined spaces where gas concentrations or oxygen deficiency exist. Hand- or motor-driven blowers.

M. S. A. OXYGEN BREATHING APPARATUS

Two compact models, providing dependable self-contained oxygen supply to users in unbreathable air, for periods of one and two hours, respectively.

OTHER M. S. A. PRODUCTS

Approved Dust Respirators . . . Inhalators . . . Masks of all types . . . Gas Indicators . . . Gas Detectors . . . Safety Goggles . . . Protective Hats and Caps . . . Edison Electric Cap Lamps . . . Safety Belts . . . Safety Clothing . . . Dust Instruments . . . First Aid Equipment. Descriptive Bulletins will be sent on request.

MINE SAFETY APPLIANCES COMPANY

BRADDOCK, THOMAS AND MEADE STS., PITTSBURGH, PA.

District Representatives in Principal Cities

partments of all prime contractors, near and far; to join eagerly in all proposals for pooling; in a word, to fight for business and leave no stone unturned.

Rule 5: All companies, large and small, should train replacements for workers likely to be drafted.

What About Conversion?

The reader will note that this report has studiously clung to the term "subcontracting." Time may prove that the word and the procedure it stands for will supply the one outstanding answer to the problem of spreading defense work.

Currently the Washington emphasis is on "conversion." This, to the public, is far too likely to imply miraculous overnight switches by companies or whole industries from one kind of production to some totally new kind of production. If the responsibility for this sort of thing is thrown wholly upon industry, industry may later suffer unjustly in the public mind for its failure to work unheard-of wonders daily.

Very often it turns out that what is now called "conversion" is the procedure formerly described as "industry-wide subcontracting." In earlier attempts this was not overly successful and many of its former advocates have lost faith in it. A case of authentic "conversion" is now taking place in the automobile industry. And it has been found that *50 to 90 percent retooling* is required, despite the fact that the plants are being "converted" to the manufacture of any and all war materials to which they are suited, rather than limited to the manufacture of airplanes as was at one time proposed, and for which most of their equipment is not suited.

It may well be that only a few such highly centralized, fast-moving industries with unrivaled technical staffs, are capable of such a performance. Even so, the retooling is taking place primarily in the plant of the prime contractor. No one can possibly expect that the Ford Motor Company, for example, will retool all of its 6,000 subcontractors. Nor can they retool themselves extensively. Such a process, if multiplied widely, would mean a long, time-taking retooling of *all* industry—the very thing that true subcontracting is meant to avoid.

"Industry-wide subcontracting," the application of defense contracts hori-

Aerial Bombs Made from Steel Saved by Preformed Wire Rope

★ By lasting longer, preformed wire rope conserves steel which America greatly needs. For example, it conserved enough steel last year through longer service to make more than 73,000 aerial bombs for our armed forces.

★ Back of the armed forces—in the industries that provide their requirements—preformed wire rope plays an important part by reducing the frequency of machine shutdowns. This wire rope lasts longer, it steadies production, and is easier and safer to handle. It saves both time and money.

★ Preformed wire rope is an essential to American industry—a necessity for the Nation.

PREFORMED WIRE ROPE

Ask Your Own Wire Rope Manufacturer or Supplier

Have you ever thought of lifting, lowering or pushing with

HEIN-WERNER HYDRAULIC JACKS

IF your factory is switching to more WAR WORK—and if you are moving old machines or setting up new ones—or if you have heavy material to be lifted or shifted—TELL US YOUR PROBLEMS and let our engineers make recommendations covering your requirements.

- Super-Powerful
- Easy-Operating
- All models in H-W line are factory-tested at 1½ times rated capacity

HERE'S WHY H-W HYDRAULIC JACKS *are easier to operate*

In a split-second, mere finger pressure is transformed into a lifting force of several tons

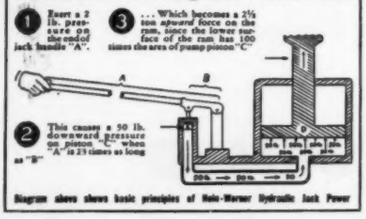
1 Exert a 2 lb. pressure on the end of jack handle "A".
3 ... Which becomes a 2½ ton upward force on the ram, since the lower surface of the ram has 100 times the area of pump piston "C"
A
B
2 This causes a 50 lb. downward pressure on piston "C" when "A" is 25 times as long as "B"
20 Ton
20 Ton
20 Ton
20 Ton
20 Ton

Diagram above shows basic principles of Hein-Werner Hydraulic Jack Power

As one of the oldest and largest manufacturers of hydraulic jacks, Hein-Werner *knows* the answers to lifting problems. And the purchasers of *over a million* hydraulic jacks made by H-W know that these jacks are compact, sturdy, safe, fast and easy to operate.

This great line includes hydraulic jacks of 1½, 3, 5, 8, 12 and 20 tons capacity... Write for details and prices... Our engineers will welcome the opportunity to make recommendations.

HEIN-WERNER MOTOR PARTS CORP.
Waukesha, Wisconsin

HEIN-WERNER HYDRAULIC JACKS
Are Built Right and Priced Right

zontally to industries comprised (unlike the automotive industry) of small, scattered units has been found likely to emphasize the tooling deficiencies which all the units have in common while causing delays and snarls without number in transportation and delivery. Often these units would figure more effectively as prime or subcontractors in regional pooling plans.

At any rate, "conversion," if it is not simply a phase of subcontracting, is enormously productive of—and hence dependent upon—subcontracting. The converted automobile plants alone are expected to generate an estimated $8,000,000,000 worth of *subcontracting*. So the latter term is still the word for our Number One production problem. It is worth noting, too, that many of the presently publicized cases of small-company "conversion" are actually those of plants which, with few tooling changes, are simply making component parts on subcontract.

The Case for the CDB

Any discussion of the Contract Distribution Branch (CDB) of WPB must give recognition to the fact that neither this agency nor its predecessors have ever had the authority to buy a nickel's worth of anything. To the credit of Floyd B. Odlum it must also be said that the field organization which he built as the Contract Distribution Division of OPM is generally well regarded.

From the start this agency has lived in a no-man's-land of conflicting policy and ill-defined authority. The appointment of Mr. Odlum under a Presidential directive appeared to grant him greater powers than he actually was able to exercise. However, he could and did expand his organization which today, under his successor, Walter H. Wheeler, numbers well over 120 field offices. Its staff, many members of which are dollar-a-year men, labors long and hard to spread the gospel of subcontracting, gives sympathetic ear and good advice to prospective subcontractors, conducts clinics, arranges "bits and pieces" exhibits, encourages every sort of pooling plan. Purchasing authority, however, has remained in the hands of the armed services, while the CDB has lost the independent status it had in OPM and has been made an adjunct of WPB's Division of Industry Operations.

The recent record of defense busi-

Why your Red Cross urgently needs

FIFTY MILLION DOLLARS, NOW

How the fund is allocated . . . What it does in service

Every dollar that you give now to your Red Cross marches into the thick of things where humanitarian help is needed most—up to the fronts and battle stations where the fighting is heaviest. Into the Red Cross hospitals and First Aid units where prompt medical attention and supplies may save innumerable lives. And throughout our broad land to train and equip volunteers to meet any emergency that may strike.

How the $50,000,000 War Fund is Used

SERVICE TO THE ARMED FORCES $25,000,000

Provides for the care, welfare and morale of the Army and Navy, including services to men in hospitals and during convalescence. • Provides an important link between the service men and their families; keeps the families from breaking up, supplies food, shelter, medicine, and even jobs where necessary. • Provides essential medical and other supplies outside of standard Government equipment. • Operates Red Cross headquarters at camps and naval stations. • Enrolls blood donors and medical technologists for Army and Navy needs. • Provides millions of surgical dressings, sweaters, socks, etc. through volunteer workers.

DISASTER AND CIVILIAN EMERGENCY RELIEF . $10,000,000

Supplies emergency needs for food, clothing, shelter and medical attention for disaster victims. • Assists stricken families in repair of homes and other adjustments; provides minimum reserves of essential relief supplies to prevent unnecessary delays.

CIVILIAN DEFENSE SERVICES . . . . . $ 5,000,000

Trains volunteers for home nursing and nurses' aides. • Trains nurses, men and women, for active duty with the Army and Navy. • Trains volunteers in First Aid and accident prevention. • Trains volunteers for work in Motor Corps, Canteen and Production. • Instructs men, women and children in preparedness against explosive and incendiary bombs. • Organizes for evacuation of children and their families from stricken areas. • Assists Red Cross Chapters in establishing effective coordination of emergency relief with local and State defense authorities.

SERVICE AND ASSISTANCE THROUGH CHAPTERS . $ 4,000,000

Gives assistance and service to the 3,740 Red Cross Chapters with their 6,131 Branches responsible for local Red Cross activities, particularly welfare work among the service men and their families.

OTHER ACTIVITIES AND CONTINGENCIES . . . $ 6,000,000

Provides for unforeseen expansions in program and for new activities made necessary by unexpected developments.

TOTAL $50,000,000

THE AMERICAN RED CROSS $50,000,000 WAR FUND

Note to Red Cross Canvassers: Use the material on this page to better inform contributors how their donations are being expended.

This space contributed to The American Red Cross by FACTORY MANAGEMENT AND MAINTENANCE

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are consistently turning in records of outstanding service . . . reduced finishing costs . . . greater output . . . and better quality finishing, wherever used. In the large, complete AP line, there is a coated abrasive that will fit your need. It will pay you to investigate.

JEWEL ABRASIVES

Made by Abrasive Products, Inc., South Braintree, Mass.

ness placed through the effort of CDB follows: October, 538 prime contracts and 1,615 subcontracts at a total value of $127,669,000; November, 1,054 prime contracts, 1,766 subcontracts—total value $98,731,000; December, 1,106 prime contracts, 3,811 subcontracts—total value $223,830,000; January 1 to 15, 638 prime contracts, 1,465 subcontracts—total value $76,100,000.

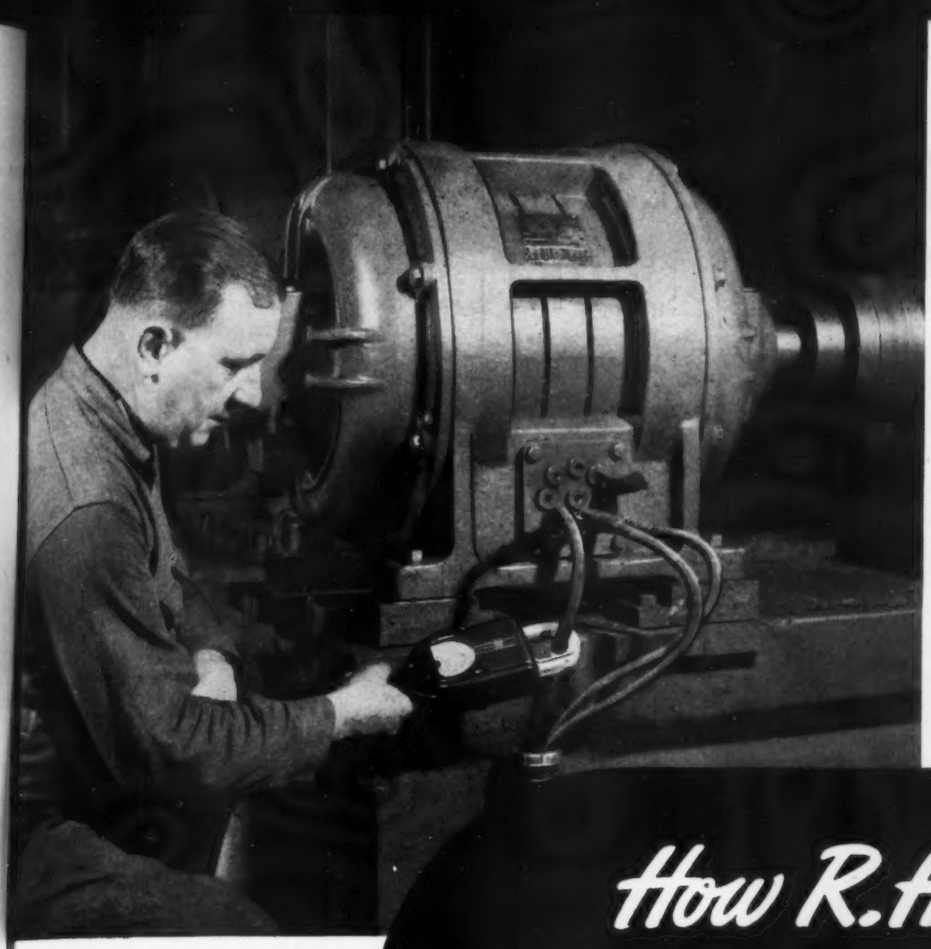
Some of the CDB field offices have been real spark plugs. The big jump in the December totals above, for example, was due to a coup executed by a far-Western contractor and an alert CDB manager who put together a plan that netted $56,000,000 of naval ship contracts for a pool in their district. In other regions the influence of CDB is minor. Yet there are many cities where prime contractors won't interview prospective subcontractors unless they have first cleared with CDB.

Within its limitations, CDB has definitely demonstrated the importance of the job it is doing and the necessity for continuing that job. It functions usefully as a polite buffer between the bewildered small business man and the hard-boiled procurement officer. It weeds out the hopeless cases and heads off many of the "promoter" types who try to get contracts first and worry about facilities later.

Perhaps the most serious criticism of CDB is the obviously huge cost of its operations compared with its results. A fair measure of the latter, however, would have to include intangibles such as the general effect of its promotional work and the instances in which it has simply given an anonymous push to some successful subcontracting project. At any rate, time is precious and even a little extra production is worth a lot. Moreover, CDB has helped bridge the trial-and-error period by bravely making most of the trials that have exposed most of the errors. It has also amassed much valuable data on facilities. Just lately this word has begun to come in from its field offices: "The big companies are turning to us now for new sources as they never did before."

Case for Armed Services

The Senate's special Small Business Committee, in its February 5 attack on the "ruthlessness" of the government toward lesser producers



How R. H. Forbes gets load and voltage facts IN A HURRY!

"WITH our plant operating three shifts a day, seven days a week, we must watch our electric equipment closely to keep it operating at peak efficiency and to prevent breakdowns. That means constant testing.

"The G-E hook-on volt-ammeter is the handiest instrument we have for this work, because it measures volts as well as amps, and enables us to make our tests quickly."

These are the words of R. H. Forbes, chief electrician, United Paperboard Company, Thomson, N. Y.

A 6-in-1 Instrument

The reason why the AK-1 hook-on volt-ammeter is so handy is that it's really six instruments in one. It has six ranges—0–15/60/150/600 amperes and 0–150/600 volts (for a-c circuits only).

To measure amperes, all you do is hook it around a conductor, flick the selector switch to **AMPERES**, and there's your measurement—no cutting of conductors, no interruption of service.

To measure volts, all you do is connect the voltage leads, snap the switch to **VOLTS**, and take the reading. You don't need any extra equipment.

Extension poles, in four- and six-foot lengths, are available for using the AK-1 on high-voltage circuits, and for reaching into inaccessible places. Also, a cowhide leather carrying case can be obtained for protecting the instrument when it is not in use.

For complete details, ask your G-E office for a copy of Bulletin GEA-2950. Or write to General Electric Company, Schenectady, N. Y.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

THE GOVERNMENT SUGGESTED THAT WE PRINT THIS BOOK!

...to help you meet your "shortage" problems!

IF you're having trouble getting raw materials . . . if shortages are threatening to squeeze you out . . . this book may contain information that will help you stay in business.

We're publishing it at the suggestion of the Government to show that flat glass, in its many shapes and forms, can provide a practical substitute for many strategic materials.

The book contains a brief description of the leading Pittsburgh Glass Products, together with technical data about properties and characteristics, availability information, and a list of suggested uses for each.

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PITTSBURGH PLATE GLASS COMPANY

"PITTSBURGH" stands for Quality Glass and Paint

trounced the procurement offices of the War and Navy Departments as soundly as it did WPB and the Treasury for alleged "big business" bias.

Officers on active duty seldom get a chance to defend themselves. They have their side of the story, off the record, and it goes something like this:

"When you're out to buy something in a hurry, you go to the places where you know it's for sale. We could spend years shopping around among the very little plants, but we haven't got years to spend. We're glad to hear from the little fellows who really have useful facilities and really dig for the work. But so many of them have no idea of tolerances, no engineering forces. They'd try anything, spoil a lot of materials, and cause endless delay."

The inhibitions of procurement officers, which sometimes give rise to the cry of "red tape," are numerous and natural. Most of these men were raised in the fear of witch-hunting Congressional committees. In the War Department especially, economical, orderly buying was drilled into them as a gospel. When the original directive was issued, creating the Odlum DCD and relaxing restrictions on competitive bidding and performance bonds, one prominent procurement officer sighed and exclaimed:

"Oh, boy, here we all go to Leavenworth. Besides, this will expose us to all the pressure that Congressmen can put on for orders in their districts."

It's a point of view. The procurement officers also have their side of the story when they are accused of being too stiff-necked about tolerances or of changing specifications too frequently. If the shell fails to explode, if the weapon isn't superior to the enemy's, it's *their* fault.

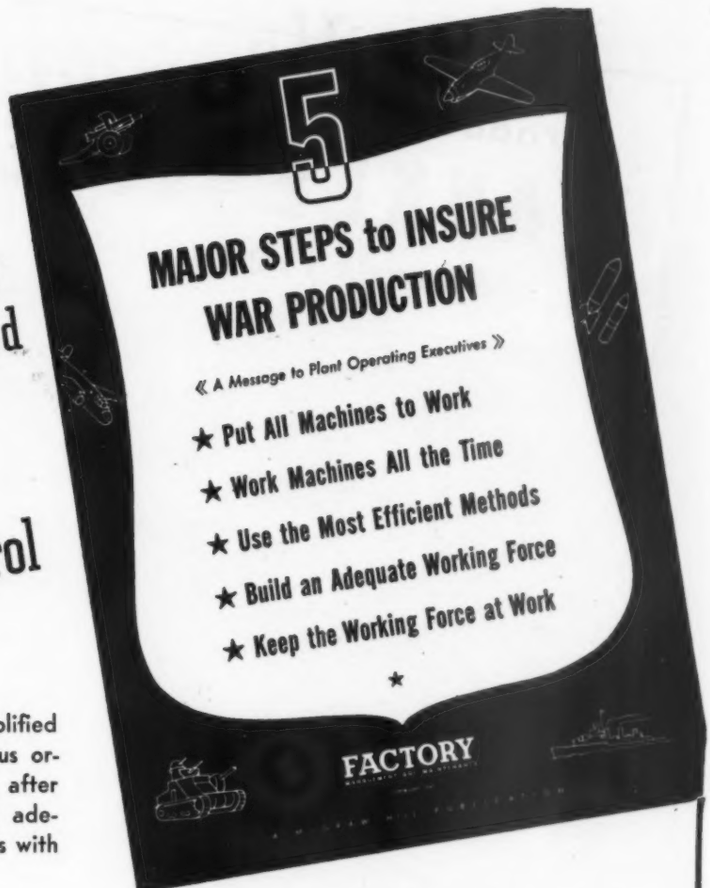
Another criticism of the procurement staffs, quite frequently heard, is that the higher ranking men are near the retirement age which makes them unduly cautious and unreceptive to new ideas. It is agreed, however, that the vast expansion of the field procurement organizations, the promotion of younger officers, and the employment of thousands of civilian assistants schooled in industrial thinking, are already working a change.

Obstacles—Solutions

"Government red tape," "prime contractor indifference," and "small business inertia" are the general terms

4 out of five of these steps are facilitated by . . . . .

McCaskey Production Control


5
MAJOR STEPS to INSURE WAR PRODUCTION
« A Message to Plant Operating Executives »
★ Put All Machines to Work
★ Work Machines All the Time
★ Use the Most Efficient Methods
★ Build an Adequate Working Force
★ Keep the Working Force at Work
★
FACTORY

War production has intensified the need for simplified control of production almost over night. Numerous organizations are fighting one production emergency after another. Emergencies that can be prevented by adequate control; that are prevented in scores of plants with McCaskey Controls, providing, for example . . .

- A simple method of coordinating the flow of finished parts required for assembly to avoid delays resulting from missing parts . . .
- Forecasting production delivery . . .
- Meeting delivery dates promised . . .
- Scheduling machines, determining machine loads and making job assignments so that all machines may be put to work and worked all the time . . .
- Checking machine production to make sure that standards set are realized . . .
- Following-up production without dependence on stock chasers . . .
- Providing day-to-day cost and payroll data for immediate control of unexpected increases . . .

These and numerous other requirements, problems undoubtedly similar to yours, are solved with a minimum of clerical effort and expense thru McCaskey Controls.

Specific information on their application and results will be sent promptly on request. Experienced representatives are available to analyze your requirements and offer practical recommendations. You incur no obligation in asking for our suggestions. Write today.

Do not sidetrack McCaskey results through fear of installation difficulties. You can install "in the teeth of the gale" without the least interruption of production.

Reports from Plants Using McCASKEY PRODUCTION CONTROL SYSTEMS . . . .

The following, from a well-known Chicago manufacturer is typical of many other reports of specific advantages resulting from the use of McCaskey controls . . .

"In our shop departments McCaskey provides for the assignment of work to machines or operators. At times as many as five jobs are scheduled ahead of each machine or operator. This visible assignment of jobs reduces non-productive time.

"In our central production office, McCaskey gives us a visible control over all work-in-process by piece part numbers and operations. *Some of our part numbers have as many as forty operations.*

"McCaskey gives us a graphic status of all work-in-process . . . a continuous check on production by piece part numbers and operations, and an instant check on counts at every operation. Our control is constantly up-to-date.

"The flexibility of McCaskey Controls has enabled us to take care of our plant and manufacturing expansion with a minimum of additional clerical overhead."

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

McCASKEY INDUSTRIAL CONTROLS

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Production means Victory

"YANKEE" VISE

Speeds Production

War means all-out production. All-out production demands the tools that can stand the punishment of ceaseless hours, endless work and still speed up the job. The "Yankee" Vise is just such a tool. Here's why:

1. **Sides, front end, and base are milled for interchangeable and accurate positioning on face plate or machine bed.**
2. **Detachable swivel base permits the vise itself to be transferred from bench to machine for drilling, tapping, or milling operations—and back to bench again.**
3. **Quickly, easily, and economically converted into milling, drilling, and tapping jigs.**
4. **Hardened steel block with V-shaped grooves, furnished as standard equipment, holds round stock securely.**

"Yankee" Vises are made in four jaw widths and two styles. No. 991–1½"; No. 992–2"; No. 993–2¾"; No. 994–4". These same sizes with the detachable swivel base feature are Nos. 1991, 1992, 1993, 1994.

Order from your supply house or write North Bros. Mfg. Co., Dept. FMM3, Phila., Pa. Every effort is being made to reach a balance between supply and war-time demand.

"YANKEE" TOOLS

make good mechanics better

North Bros. Mfg. Co., Phila., Pa., U. S. A.

Established 1880

under which a score of criticisms were detailed to FACTORY by observers in the field. Nearly all those who pointed out existing obstacles to practical subcontracting had constructive solutions to suggest.

A CDB engineer observes that certain ordnance parts which could be stamped and welded are being forged and turned to unnecessarily high tolerances. He proposes an engineering board of review at Washington to simplify the specifications of thousands of such items from the viewpoint of the producer instead of the designer, and to freeze specifications where possible. Nearly all those to whom the plan is broached, including procurement officers, concur.

A management consultant points out that the present 15 percent price differential which the government allows to encourage subcontracting is not, in most instances, nearly enough. He supplies data to show that the cost differences usually run closer to 40 percent. He suggests that prime contractors be required to furnish blueprints, jigs, fixtures, and special tools to subcontractors whenever the contracting officer deems them necessary but that the prime contractor be compensated for them, the cost to be included in a scaled over-run determined by the procurement officer as a percentage of the original contractor's costs. FACTORY learned of large companies partially stymied on subcontracting because they held large government orders at fixed prices which would not allow them to subcontract extensively without heavy loss.

Another man, not connected with the government, deplores the "overlapping and conflicts of government agencies" in the field. He urges that the procurement districts of all the armed services (no two of which are laid out alike) be made to conform to the Federal Reserve districts and that all production and procurement functions be centralized in each district under a "little Nelson." He further proposes that all data on facilities be concentrated in the hands of CDB which should also be given complete charge of conversion. "If not that," he says, "transfer CDB to the armed services and make it the hub of WPB in the field."

A Washington official complains of the "totem worship of prime contractors" and suggests that assembly plants and stockpile plants be set up and op-

Through HIGH SPEEDS and FLYING TAR!

OUT of this maze of rollers, shafts and gears come rolls of fireproof roofing paper — the rate of output is amazing! Known as a "rewinder", it takes the big rolls off the impregnating machines and rewinds them into smaller commercial rolls. Built from the ground up, *right on the spot,* it is truly a wonderful example of Yankee ingenuity — and the adaptability of Fafnir Ball Bearings.

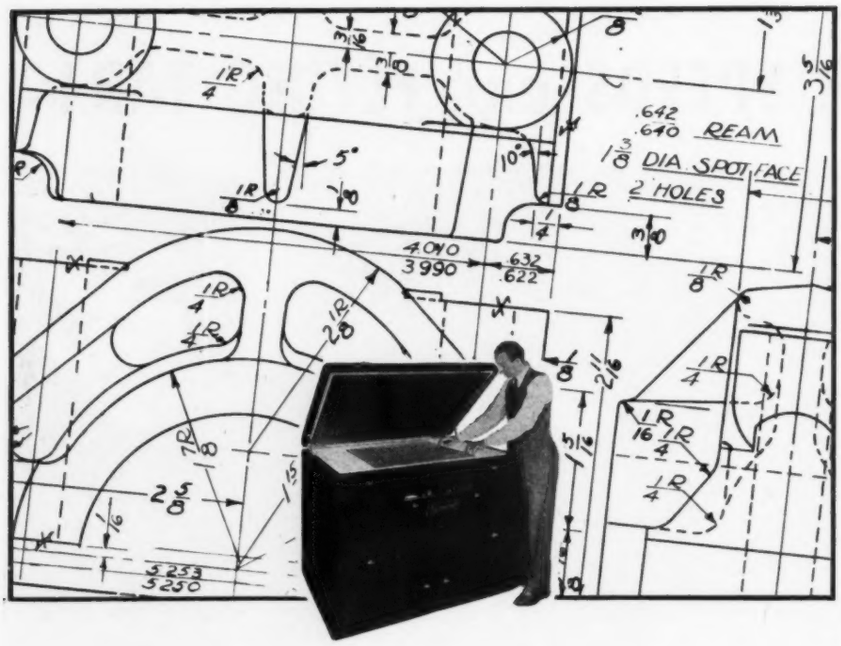
Fitted cleverly into the design of the machine, two Fafnir Ball Bearing Hanger Boxes support one end of the main shafts. Fafnir Pillow Blocks support the other ends. These Fafnirs have been on the job for more than 8 years — running smoothly and trouble-free in veritable clouds of flying tar and gummy lint. The master mechanic says, "All the care they need is an occasional greasing!"

Tough operating conditions hold no terrors for Fafnirs. Wherever the job calls for extra stamina, extra service, you'll find a Fafnir Ball Bearing Unit that will fit the most exacting requirements. Fafnirs alone offer the Wide Inner Ring Ball Bearing and Self-Locking Collar that simplify and speed installations. Only Fafnirs have Balanced Design — larger balls, deeper races — that means longer bearing life. The Fafnir Bearing Company, New Britain, Conn.

FAFNIR

Ball Bearings

THE BALANCED LINE—
MOST COMPLETE IN AMERICA



The Draftsman that does 24-Hours' Work in 15-Minutes

● EVER NEEDED additional blue prints when the original tracing was not available? PORTAGRAPH—a modern photo-copy unit—will reproduce on tracing cloth, tracing paper, or standard photographic paper *any type of* blueprint, drawing or tracing! Think of it! No retracing. No drawing. No checking. No errors. PORTAGRAPH is simple, costs little to operate and requires no dark-room.

Portagraph Has Many Uses

For example, the expensive, time devouring retyping of specifications is accomplished by PORTAGRAPH in minutes with absolute accuracy! Vendor's information, sub-contracting data, priority papers, production records, important letters and a host of other material can be copied swiftly and economically.

Send the coupon, today, for free facts on curing complex drafting, engineering and copying problems in your plant.

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erated regionally by the government which would then take virtual charge of the whole subcontracting process. On the other hand, FACTORY is told again and again that "pooling" has been a practical failure and that it never succeeds without a "strong, firmly entrenched prime contractor."

Men who have been trying hard to put "pools" together complain bitterly of "political" interference from Washington which upsets their negotiations with procurement officers in the field. A "pool" submits a low bid only to find itself underbid at a figure that is patently below cost.

"The men who turned in the lower bid know very well they'll lose at that figure," exclaimed one disappointed bidder. "But they have friends in Washington, and they know also that when they get into production and run into the red the government will bail them out, revise the price, and give them a profit."

Nearly everyone is glad to see competitive bidding replaced by negotiation and hopeful that contracts even larger than $1,000,000 may be negotiated in the field without Washington review. Nearly everyone is aware also of the potential evils of cost plus fixed-fee agreements, as brought out in the House probe of the case of Leon K. Shanack, a broker who allegedly netted $72,000 on $228,000 worth of subcontracts. One consultant suggests that all costs be assumed and disbursed by the government and a flat fee paid for management services on the basis of estimated costs. This, he points out, would remove any incentive to increase costs unnecessarily.

A high procurement official in Washington uses the Shanack case to point a moral to prime contractors.

"Why let your profits slip into the fingers of the 5 and 10 percent boys," he demands, "when you can cut them out by building your own subcontracting organization and utilizing the government services purposely set up to help you?"

On the other hand, a field procurement officer in a district where unusually good results in subcontracting have been obtained, says surprisingly:

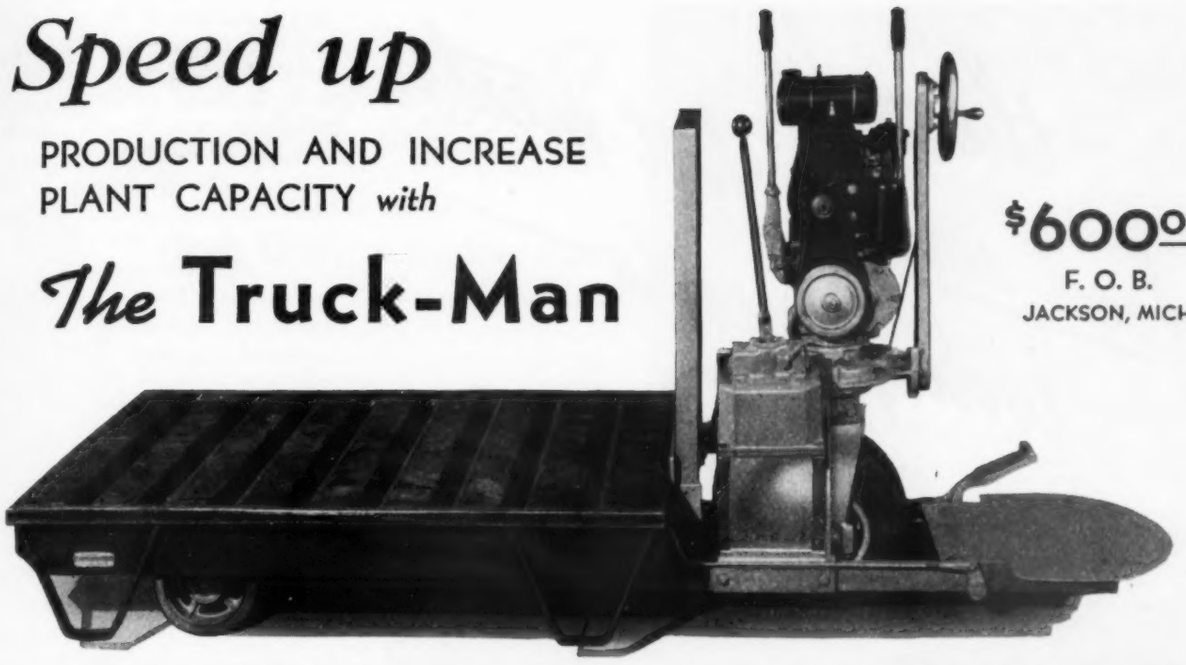
"We encourage any honest broker who knows his engineering and comes to us with actual facilities at his disposal."

The general operations and policies of the government and private agencies and industrial firms which have ap-

Speed up

PRODUCTION AND INCREASE
PLANT CAPACITY *with*

The Truck-Man



$600.00
F. O. B.
JACKSON, MICH.

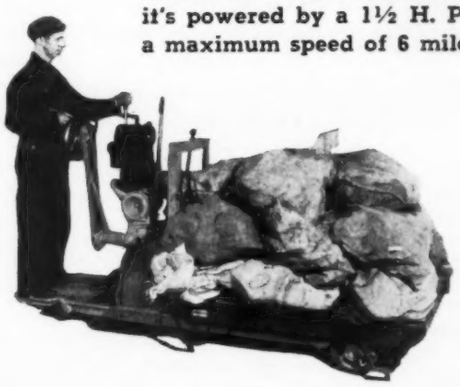
ONE TON *Industrial Shop Truck* - - -
designed for rapid and efficient movement of Materials

Designed by an automotive engineer for hurry-up work in his own plant. The use of quantity-produced, time-tested units makes possible low first cost.

Exhaustively tested, the Truck-Man proved so indispensable in speeding production that it is now being produced by a quality manufacturer to do the same great job for you.

One or more in your plant can learn to operate the Truck-Man within a few hours and before you know it will be taking load after load anywhere they could be taken by hand truck of the same size and capacity . . . and taking them many, many times faster.

The capable, sturdy, rugged 800-pound Truck-Man is just as you see it above, save that skids are extra equipment. With capacity of 2,000 pounds, it's powered by a 1½ H. P., 4-cycle, air-cooled Briggs & Stratton engine. Has a maximum speed of 6 miles per hour. Overall length is 99 inches, wheel base 54 inches. The elevating platform is 54 inches long, 27 inches wide, lift 3¾ inches. It has hydraulic lift and snubber . . . platform height is $9\frac{3}{16}$ inches. Grease-sealed ball and roller bearings throughout.



The Truck-Man turns in its own length . . . is quickly and easily reversed by rotating the power unit 180 degrees. Forward and reverse speeds are the same.

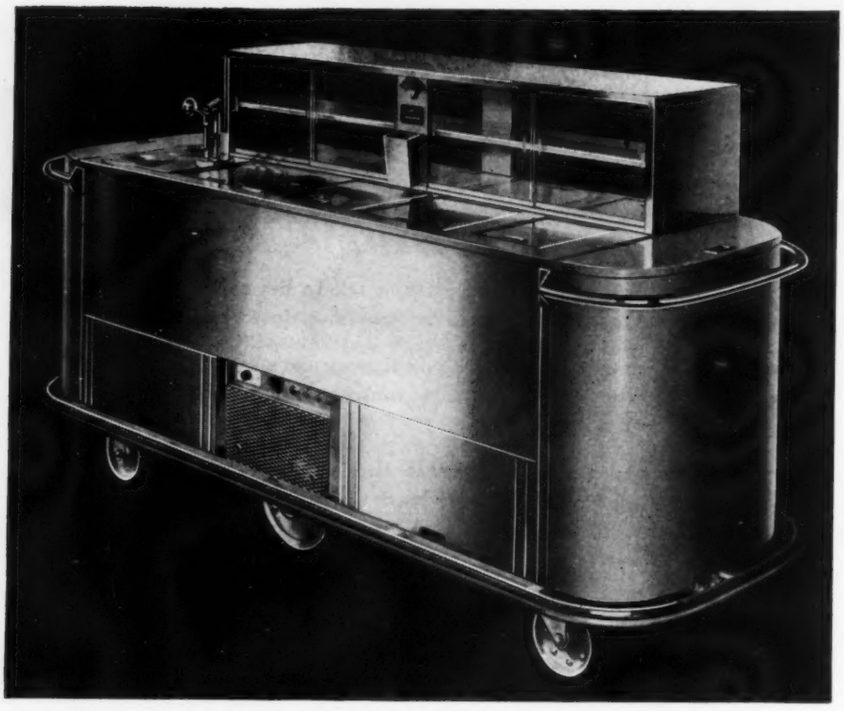
Write for literature and complete information.

YARD MAN, INC., Jackson, Michigan, U.S.A.

the only food service that meets today's needs—

Ideal

ROLLING CAFETERIAS



This Model C-1030 Ideal Rolling Cafeteria serves all hot and cold foods and, when not in active use constitutes a perfect storage unit, keeping foods hot or cold as desired.

● **Because it saves and extends the most valuable things in factory operation today, food service by Ideal Rolling Cafeterias is the accepted and approved method of feeding workers in war industries.**

Bringing the food to the worker in the Rolling Cafeteria saves time, avoids confusion, reduces accident risk, keeps manpower at the peak of efficiency, promotes morale, saves floor space and cuts out food waste.

Not merely a glorified candy-wagon but a complete mobile equipment for serving and storing all hot and cold foods. There are many standard models meeting every requirement.

Write for complete data.

THE **SWARTZBAUGH MFG. CO.,** TOLEDO, OHIO

DISTRIBUTED BY **THE COLSON CORP.,** ELYRIA, OHIO

plied themselves to the promotion of subcontracting are fairly well understood. Here and there new plans have been tried out or merely proposed which are not as yet well known.

For example, in Rhode Island a plan was launched by the State Industrial Commission and carried through by CDB whereby careful check is kept on all idle machine-tool capacity in the district. Once a week in the Providence Sunday papers there is published a forecast of idle machine-tool hours to be available during the week. Prime contractors can match this list against their needs and, through CDB, contact the owners of the idle tools.

In Denver, Colorado, the CDB holds round table conferences of prime contractors to whom are submitted the facilities lists of prospective subcontractors. These are dealt around the table and sorted out into "blocks" of balanced, well-rounded facilities. Thus the procurement officer is able to visualize the "block" as a unit rather than as a scattered group of unrelated facilities.

In Cleveland, the highly active Ordnance District Deputy Chief, Lt. Col. H. M. Reedall, has outlined a plan for bringing hundreds of minor machine-tool shops together physically under one roof. The City of Cleveland has offered the use of a large convention hall for the purpose. The plan is still on paper, but will go forward as soon as the many obvious difficulties, such as provision of power facilities, can be solved. Meanwhile a New Hampshire manufacturer has been experimenting successfully on a smaller scale with the same idea, both by bringing the equipment and personnel of small shops into his plant and by setting up shops for their tenancy in other cities.

Throughout the country industrial and trade associations are giving greater thought and effort to the problem than ever before. The National Association of Manufacturers has announced its promising "casting office" plan under which prime contractors will file with WPB a weekly list of specifications of work available to subcontractors. WPB will classify the work according to a simplified code. Both prime and prospective subcontractors will be furnished with master translations of the code. Thus subcontractors can run quickly through the coded data and ascertain their chances of supplying the need. An-

Mop up the Hot Spots

with wire that won't bake out

Take a trouble-shooting trip around your plant . . . check up on the power and lighting circuits that run around boilers, furnaces, steam lines, soaking pits, kilns, lehrs or other hot spots . . . and don't forget the motor leads that are taking more than their share of overload-heat, oil and grease. These are the spots where *trouble* starts—where wire and cable fail—spots where *permanently insulated* Rockbestos should be used.

Rockbestos wires, cables and cords are insulated to stand up in installations where other wires fail. They're not affected by heat and moisture, oil, grease or corrosive fumes. They can't burn. They mop up wire failures and prevent production interruptions.

Rockbestos A. V. C. Motor Lead Cable. Insulated with felted asbestos, heat-sealed varnished cambric and covered with an asbestos braid. Resistant to heat, flame, moisture, oil and grease. Sizes: No. 18 AWG to 1,000,000 CM. Underwriters' and Nat. Elec. Code Type AVA, max. operating temp. 110°C. (230°F.).

Rockbestos A. V. C. Power Cable. Laminated felted asbestos and varnished cambric insulation and a rugged asbestos braid withstands heat and condensation in boiler rooms, steam tunnels, etc. Sizes: No. 18 AWG to 1,000,000 CM. Underwriters' and Nat. Elec. Code Type AVA, max. operating temp. 110°C. (230°F.).

Rockbestos A. V. C. Boiler Room Wire. High dielectric varnished cambric, felted asbestos and a heat, flame and moisture resistant asbestos braid insures permanent performance in hot locations. Sizes: No. 18 to 4/0 AWG. Underwriters' and National Electrical Code Type AVA, max. operating temp. 110°C. (230°F.).

Plan Now We can take care of defense industries. When ordering specify minimum footage requirements and send in preference rating papers. Samples and catalog on request.

ROCKBESTOS PRODUCTS CORPORATION
836 Nicoll St., New Haven, Connecticut

ROCKBESTOS A.V.C.

THE WIRE WITH PERMANENT INSULATION

NEW YORK, BUFFALO, CLEVELAND, DETROIT, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

30 R&M HOISTS Speed this Firm's War Work!

◀ This view (with cover removed) shows the extreme simplicity of the R & M hoisting mechanism. Compact assembly reduces the amount of headroom and gives maximum strength. The entire mechanism can be removed after the cover is taken off.

There are no jams, no wasted time and effort in this war-geared plant! Material and finished products move like clockwork with the help of 30 R & M hoists.

You see three of the newest in action above. They're Cleveland Tramrail mounted 2-ton, all-steel super-production models with pendent, push-button control and a hoisting speed of 20 feet per minute. And spotted in other departments of the plant are 27 more R & M hoists, ranging from half-ton bantams to 5-ton huskies.

R & M hoists have provided the answer for faster material handling in all parts of the country. Their low headroom, ability to handle loads from any angle with perfect balance, and sturdy construction for trouble-free, year-around performance make them first choice for all types of industry.

Get in touch with nearest R & M sales and service office now. Or write the factory direct for complete details. It will pay you to "take it up" with R & M.

R & M SALES AND SERVICE OFFICES

Albany.....364 Broadway
Atlanta.....319 Walton Bldg.
Baltimore, Lombard & Concord St.
Boston.....55 Long Wharf
Buffalo.....2005 Delaware Ave.
Chicago....2400 W. Madison St.
Cincinnati.....418 New St.
Cleveland..352 Rockefeller Bldg.
Dallas.....1100 Cadiz St.
Denver.....1420 16th St.
Detroit.....2921 E. Grand Blvd.
Houston..3715 Harrisburg Blvd.
Jacksonville....305 Bisbee Bldg.
Newark.....700 Bergen St.
New York.....200 Varick St.
Philadelphia...401 N. Broad St.
Pittsburgh....H. W. Oliver Bldg.
San Francisco...237 Rialto Bldg.
Seattle.....216-17 Walker Bldg.
Syracuse..204 State Tower Bldg.
Montreal....Lyman Tube & Supply Co., Ltd.

ROBBINS & MYERS • Inc.

HOIST & CRANE DIVISION • SPRINGFIELD, OHIO

MOTORS • FANS • MOYNO PUMPS • FOUNDED 1878

other industrial group, the Copper and Brass Research Association, has gotten behind the promotion work of CDB and issued a booklet entitled "How Small Industries Can Go After War Work."

There are many signs that the nation is awakening fast to the urgency of the job ahead and that industry is buckling down to the tremendous engineering task which production, through subcontracting, involves. Said Donald M. Nelson recently:

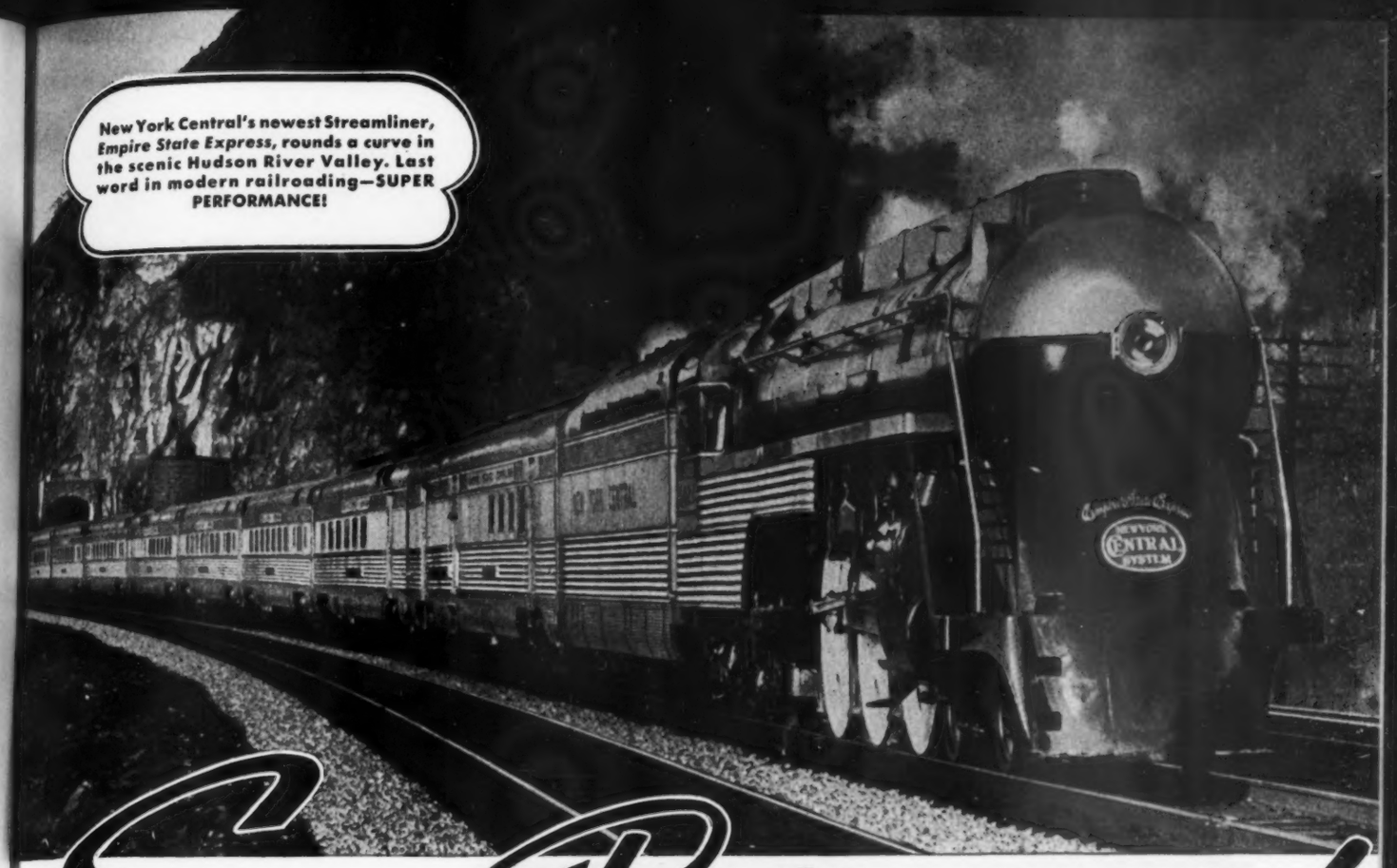
"There isn't a single big producer who can't do more than he is doing now—if he subcontracts part of his job. Industry itself must find the way to do that job."

And industry will, by intensified application of the time-tested principles of good management, by going aggressively after war work until all its own machines are working all the time, and then by going after more war work until every machine everywhere is busy *all* the time.

OTHER EXAMPLES OF CONVERSION

Usual Product	*War Product*
oil burners	machine gun parts
fishing tackle, boxes	ammunition chests
ladies underwear	mosquito netting
auto parts	aircraft parts
window screens	aircraft windows
oil well rods	armor piercing shot
motors, fans	machine gun turrets
tractors	tanks transmissions
food machinery	amphibian tanks
beverage containers	oxygen tanks for planes
recording apparatus	airplane control parts
generators	shell projectiles
egg poachers	percussion caps
gas heaters and boilers	bogie wheels for tanks
thermometers	shell boosters
routine metal work	ship fabrication
safes	gun mounts
automobiles	tank engines
automobile bodies	wing parts
engines	airplane engines
automatic pencils	brass boosters for artillery shells
bronze windows	gun ring mounts
air conditioning equipment	ship, plane, and tank plants
air conditioning equipment	heating, and cooling coils
watches	precision instruments
hardware	detonating fuses
printing equipment	shell machinery
radiators and air conditioning equipment	building and ship installations
heating and air conditioning equipment	patrol boats, mine sweepers

(Continued on page 230)


New York Central's newest Streamliner, *Empire State Express*, rounds a curve in the scenic Hudson River Valley. Last word in modern railroading—SUPER PERFORMANCE!

Super Performance!

Comparable with the modern advancements in transportation is the progress recently made in electric motor construction. Very definitely do present-day HOWELL Motors give SUPER PERFORMANCE in comparison with acceptable standards. Present-day HOWELL Motors are *protected* both externally and internally—*protected* against the common causes of motor failure and high maintenance. *Yes, here are war-time motors equal to the pressure demands of war-time production.* Use HOWELL Motors—and be CERTAIN of trouble-free service at the drive end of your machines whose continuous operation is so vital to an American Victory. Write for Bulletin RS-60.

External Protection

1. Non-breakable steel frame.
2. Non-breakable malleable iron base.
3. Shield-type end plates—ventilation openings protected top and both sides.
4. No moving part exposed.
5. Dripping liquids and falling particles sealed out.

Internal Protection

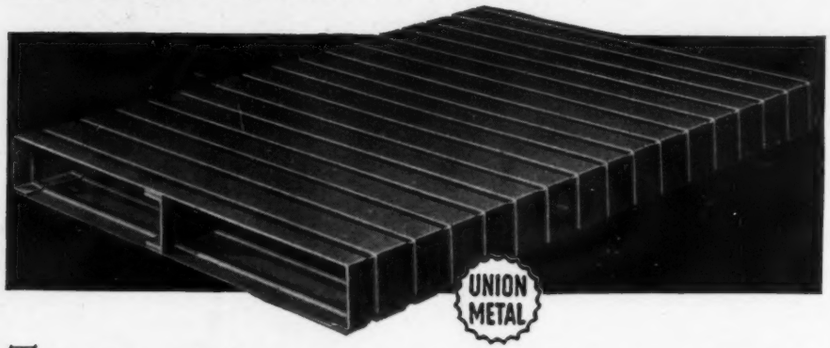
1. Windings heavily insulated—triple-treated with moisture-proof insulating varnish.
2. Rotors dynamically balanced to close limits.
3. Bearing housings diamond bored for extreme accuracy.
4. All working parts built to precision standards.

HOWELL ELECTRIC MOTORS COMPANY

HOWELL, MICHIGAN • • • *Representatives in All Principal Cities*

UNION METAL All-Steel Pallets

***designed for* LONGER LIFE, FASTER HANDLING and GREATER SAFETY...**

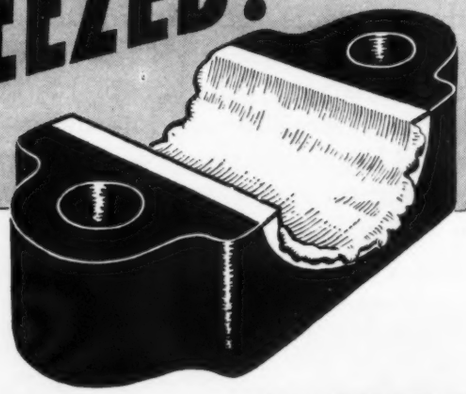


This light weight but sturdy double-faced pallet is designed for either inter- or intra-plant shipment and storage of material. Its all-steel construction assures long life. Top and sides are one integral piece and the bottom is securely welded in place. No splinters, nails or sharp edges to tear cartons, mar surfaces or injure worker's hands. No danger of boards splitting or loosening with resultant collapse of tiered loads.

Write for catalog describing this and other units in Union Metal's complete line of modern steel boxes, skid platforms and pallets.

THE UNION METAL MANUFACTURING CO.
CANTON, OHIO

SQUEEZED!



Replace with

POWER Nickel-Genuine BABBITT

A uniform, nickel-treated, genuine babbitt alloyed particularly to withstand extremely heavy sustained pressures. A superior bearing metal in which hardness, strength and high melting and softening points are combined. For use in such machines as marine reciprocating engines, water turbines, paper mills and rolling mills.

MAGNOLIA METAL CO. • ELIZABETH, N. J.

MAGNOLIA BEARING METALS

EXAMPLES OF CONVERSION

(*Continued from page 228*)

steel kitchen ensembles	anti-aircraft shells
watches	chronometers; stop, time, and deck watches
gyroscopes	aeronautical instruments
pens and pencils	machining of war products
washing machines	airplane wing parts
wood products	powder plant and arsenal fixtures
stoves and furnaces	powder cans
coffee strainers	flyers' kits
aluminum products	lighting reflectors
scientific instruments	machinery for special lenses
crimp roofing steel	base plates and
shingles and barrels	shell castings
piston rings	dummy fuses
razors and blades	primers
silverware	forceps for medical corps
watches and clocks	turn and bank indicators
metal products	cartridge clips
oil well supplies	inspection tanks for cargo vessels
sashes and doors	furniture for Maritime Commission
watches	ordnances fuses
electric shavers	grinding work
clocks	armament packing boxes
watches and clocks	ordnance fuses
machine shop work	seal rings
fish nets	camouflage nets
cans and containers	cartridge box liners
automobiles	two-wheel Army trailers
duck materials	covers for flyer's cases
leather products	holsters
wheel and car construction	castings and airplane parts
body repair	steel lockers
plate glass	machine gun emplacements
special machinery	blades, screws, and keys
guard rails	anchors
farm power equipment	forging and machining shells
tear gas and police protective equipment	cartridges, ignition, flares, parachutes
electric fans, dryers, heaters, and motors	aircraft parachute shells
agricultural implements	shells
auto equipment	cartridge cases
advertising specialties	cartridge cases
aluminum ware	cartridge cases
radio vibrators, antennae	bomb-nose fuses
watches	mechanical time fuse parts
marine engines, jigs, dies	fuse plugs
aluminum ware	fuse parts

Handling Materials for WAR INDUSTRIES

EASTON is building the following types of equipment to meet the material handling requirements of all industries directly or indirectly engaged in war production:

INDUSTRIAL CARS
for hand or locomotive haul, or electric

INDUSTRIAL TRAILERS AND SEMI-TRAILERS
for hand, tractor or motor-truck haul

ELECTRIC TRUCKS
load-carriers, low-lifts and tier-lifts

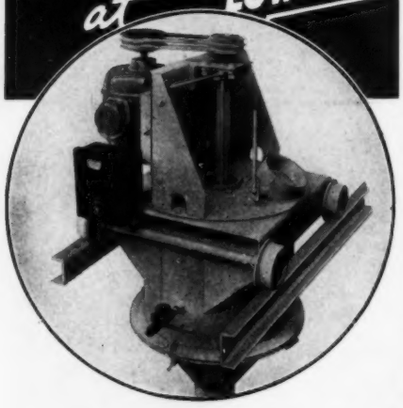
DUMP BODIES • TURNTABLES • ACCESSORY EQUIPMENT

ENGINEERING COUNSEL — So that you may haul bigger payloads today — and every day — Easton Engineers are at your service. When you can't wait for deliveries on new equipment, a practical Easton survey may show you the way to immediate speed-ups, may help you to get better service from old equipment, or may assist in locating serviceable equipment. Write to Engineering Counsel, Easton Car & Construction Company, Easton, Pa.

EASTON

EASTON CAR & CONSTRUCTION COMPANY • EASTON, PA

NOW FOR THE FIRST TIME
WET DUST DISPOSAL
From DRY TYPE DUST COLLECTORS at LOW COST

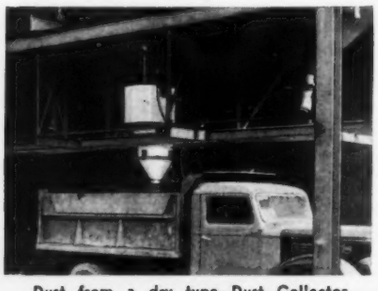


HERETOFORE the disposal of dust accumulated in dry type Dust Collectors has necessitated more than ordinary care because of the tendency for some of the dust to disperse into the air upon emptying the hopper.

This problem has now been solved by the new American Wet Disposal Unit which wets and mixes with water or other liquids the collected dust discharged from the hoppers of dry type dust collectors such as the American "Dustube" and the American "High Efficiency Cyclone."

The initial cost of either of these two collectors *plus* the Wet Disposal Unit is much less than the average wet system; and the cost of operation is less, too, because there is less water consumed (the unit operates only when dust is discharged) and the sludge does not require dewatering.

Write for other important details today and ask for Circular No. 52.



Dust from a dry type Dust Collector being discharged as a wet sludge by means of a Wet Disposal Unit.

AMERICAN FOUNDRY EQUIPMENT CO.
374 S. BYRKIT ST. MISHAWAKA, IND.

Management Shorts

(*Continued from page 74*)

the change in the name of the group. The word "safety" has been used so long that it has become dog-eared and care-worn—so ours became the "Accident Prevention Committee," not the Safety Committee.

•

Crawler crane purchased to unload steel sheets from cars under a low shed paid for itself not in the eight years expected, but in three. Handled the sheet steel so rapidly that it was put to work on other jobs—scrap piles, unloading coal, handling borings.

•

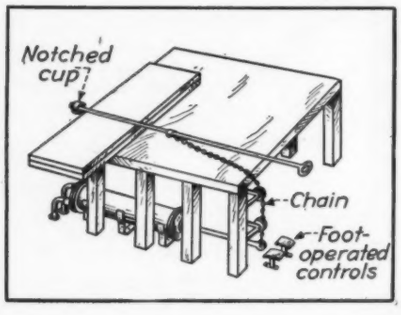
Rod Puller Speeds Up, Eases Positioning Job

DANIEL BERG, Bridgeport, Conn.

When we opened a new plant, the weight of our units of manufacture was increased from 150 to 625 pounds. This gave rise to a problem we had not previously had.

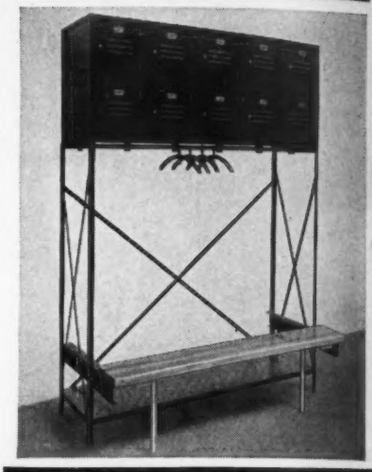
There were a number of good reasons why the original planning had not included the operation of moving these units a distance of about 2 feet. The units were piled one on top of the other in piles of ten, and since the next operation was one that had to be done individually, this made it necessary to pull the units off the pile one at a time.

To begin with, we had two men standing about 6 feet apart, pulling these 8-ft. units the necessary 2 feet so that they would be in line for the next operation. Each man was equipped with a hand hook, and even then it was a real hard and fatiguing job.



We saw at once that this was not the right way to do it. So as a first step we made slight improvements on the hand hooks through the use of a cup on the end, which had teeth cut into it. This cut down the slip-over. Next, we at-

PENCO
STEEL LOCKER UNIT ACCOMMODATES TEN



CUTS FLOOR SPACE IN HALF

The Penn-Kelsey Unit provides complete facilities for ten persons in half the floor space ordinarily required. Releases extra floor space for productive purposes and provides maximum ventilation.

Each low-cost, portable unit has an open coat space 56½" high with the coat hangers permanently attached. Perforated metal shoe rack at bottom; a wooden seat, 8½" wide and 18" above the floor, attached to the frame and ten private locked compartments, each of which is 12" wide, 18" deep and 12½" high. Doors are flanged on all sides for strength.

Heavy furniture steel is used in the assembly, with compartment door frame members spot welded for strength and rigidity. Nuts and bolts are cadmium plated to resist corrosion. Rubber bumper silencers at contact points. Overall size of each unit is 60" wide, 18" deep and 87" high, accommodating ten persons.

Write for catalog and prices.

1869 Penco

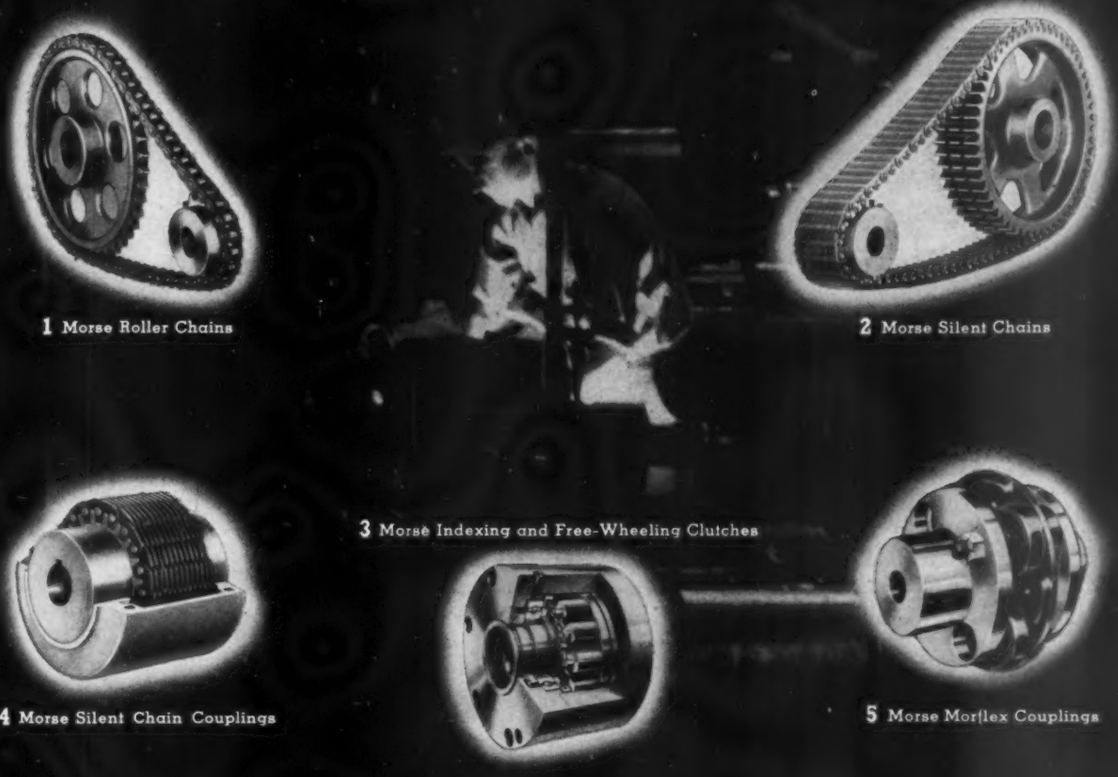
Steel Lockers & Shelving
Storage Cabinets
Tool Stands & Cabinets

Penn Metal Corporation of Penna.
In Business Continuously Since 1869
26 Oregon Avenue, Philadelphia, Pa.

FOR FULL

MOBILIZATION

OF POWER FACILITIES


1 Morse Roller Chains
2 Morse Silent Chains
3 Morse Indexing and Free-Wheeling Clutches
4 Morse Silent Chain Couplings
5 Morse Morflex Couplings

DEPEND ON

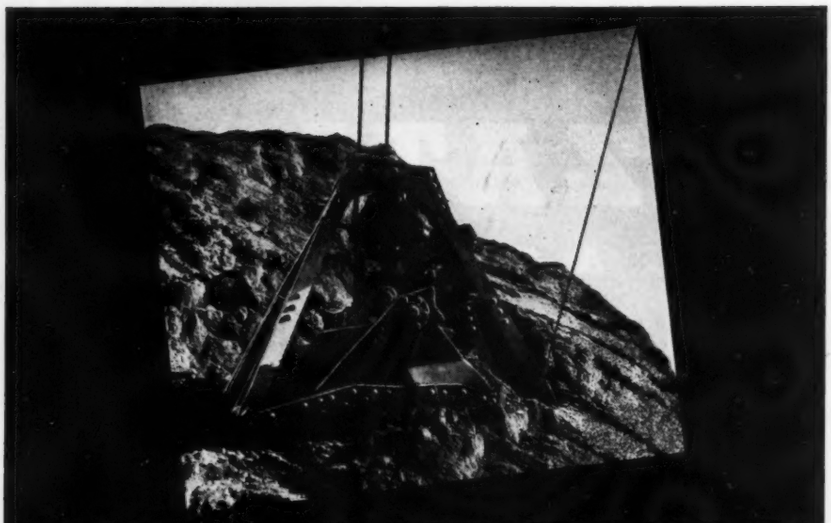
MORSE DRIVES

In these days of "all out" production, the job of efficient, dependable power transmission becomes extremely important. Power loss through inefficient drives can seriously effect your production schedules. Insure against production set-backs by transmitting all the power with Morse Drives. Regardless how large or small your drive requirements may be—Morse Drive equipment will meet your needs more efficiently and economically. Morse Silent and Roller Chains have many exclusive features. They deliver at 99.4% efficiency. Don't overlook the many advantages of Morse Silent Chain and Morflex Couplings. They are dependable, long lasting and have proven themselves worthy in hundreds of different installations under the most severe conditions. Morse Indexing and Free-Wheeling Clutch Couplings are ideal for indexing and free-wheeling purposes—available in many sizes. You will profit with Morse Drive equipment—consult the Morse man in your territory—today.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.



YOU CAN BANK ON A BROWNHOIST BUCKET

Industrial Brownhoist buckets represent the last word in good design and construction. Light weight is combined with unusual strength. Rope wear is reduced to a minimum. Because of the clean, deep bites they take, hand shoveling is practically eliminated. Standard buckets on hand ready for immediate delivery. Write for further facts.

INDUSTRIAL BROWNHOIST

BAY CITY, MICHIGAN • DISTRICT OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO

A BITE LIKE A SHARK'S!

FLOORS SHED HARD, CAKED, GREASY GRIME

when this steel-wire cup brush on the HILD Floor Machine goes to work

EVEN heavily caked deposits of metal shavings and grease cannot withstand the bite of this steel-wire cup brush when driven by the powerful HILD Floor Machine. It is equally effective for wet or dry cleaning wood block, cement, etc.

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tached a chain to the hook and ran the chain over two wheels to a rod puller mounted on the floor under the piling platform. The other end of the chain was fastened to the rod puller which we positioned so that the pull was exerted at the center point of the 625-lb. unit.

Air was available, so we used that for power, although any other power would do just as well. The control pedals are foot-operated, in order that the man's hands may be free.

Our present method is both efficient and economical, because we have made the work a great deal easier for the one man who is now able to do a much better job than the two men had done before.

•

Aprons Save Waste and Keep Workplace Clean

GEORGE HILBERT, Ridgewood, N. J.

A lightweight canvas apron, costing about 50c, was the means of saving on waste and keeping the workplace clean and neat.

Before the aprons were purchased, the operators were in the habit of putting the waste in the pockets of their dresses as a temporary depository until they reached the waste receptacle. Because their pockets were soon strained to capacity or were torn, the waste did not always reach the can in good condition. When that happened the operators let the waste fall to the floor, where it not only got dirty but also spoiled the appearance of the workplace.

This condition was remedied satisfactorily by supplying the operators with 12x15-in. aprons made of a lightweight canvas material. The apron was designed as a single pocket and was tied around the waist by a strong rope. The apron has been redesigned for use in other departments so that small tools may be carried in it.

•

Sign at receptionist's window, Yankee Metal Products Corporation, Norwalk, Conn.: "At times we may be so absorbed in our work that we may not see you. This chime will serve as a gentle reminder that you are waiting."

•

Hoist Handling Lumber Saves $100 Monthly

H. C. WHITSELL and P. A. KETCHPEL, West Englewood, N. J.

The old method of handling lumber in a box shop was unloading it from box cars onto barrel trucks, trucking it several hundred feet towards south end of the building, loading it on a belt conveyor rising to the second floor. On the second floor

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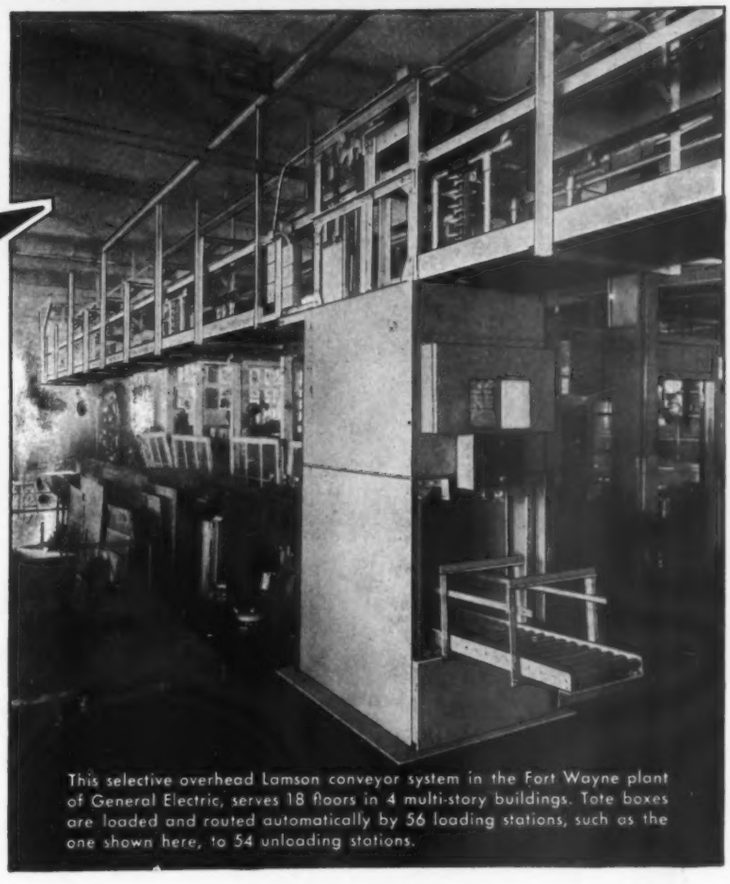

This selective overhead Lamson conveyor system in the Fort Wayne plant of General Electric, serves 18 floors in 4 multi-story buildings. Tote boxes are loaded and routed automatically by 56 loading stations, such as the one shown here, to 54 unloading stations.

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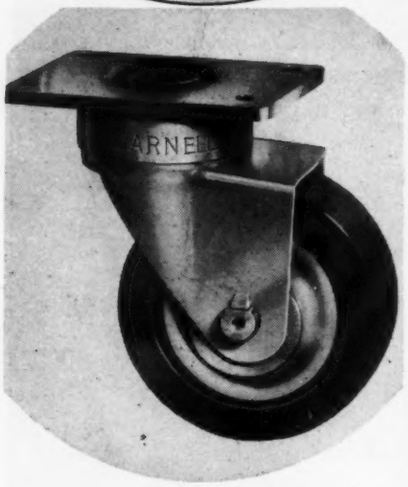

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the lumber was removed from the conveyor, placed on barrel trucks again, and moved 300 feet toward north end of the building to the storage areas, where it was piled. This took eight men two-and-one-half days time per car.

A hatchway was cut in the second floor, and an electric hoist equipped with a fork-type cradle was mounted on a short track over this hatchway. The hatchway was equipped with a guard rail and a door that fitted flush with the floor when closed.

By the new method the whole pile of lumber is lifted from the truck on the first floor and set directly on a truck on the second floor. From there it is moved to the storage areas and piled.

The total movement of the lumber is shortened, the number of men required is reduced so that the saving amounts to $25 per car or $100 per month.

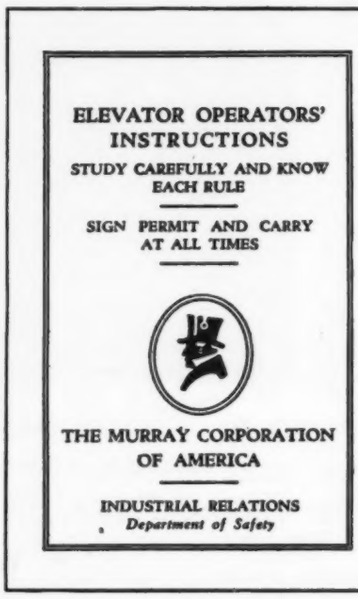
•

Rules for Operators of Hazardous Equipment

R. A. SHAW, Director of Safety, The Murray Corporation of America, Detroit

A series of little booklets has been our means of insuring that operators of hazardous equipment get proper instruction in the correct and safe operation of that equipment. Besides the one for elevator operators, shown here, they have been prepared and printed for such tasks as welding, crane operation, trucking, and bandsaw operation.

The enumerated instructions are classified in groups such as emergencies, safety, maintenance, housekeeping. In the crane rule book, six simple sketches show proper signals to cranemen.

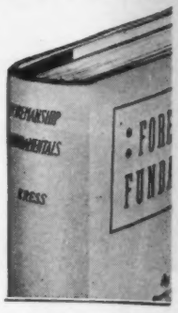

ELEVATOR OPERATORS' INSTRUCTIONS
STUDY CAREFULLY AND KNOW EACH RULE
SIGN PERMIT AND CARRY AT ALL TIMES
THE MURRAY CORPORATION OF AMERICA
INDUSTRIAL RELATIONS
Department of Safety

On the inside of the book cover is a form that, when properly filled out and signed by the foreman and the safety engineer, shows that the bearer has qualified as an operator and understands the rules. He must carry the permit at all times.

In this new book

positive, constructive techniques hammered out of hundreds of actual situations

showing the foreman how to



—get and keep the confidence and respect of his men

—get the day's work out on time

—maintain quality standards

—keep his costs down

—improve his methods

Suppose you are concerned about lining up wage rates or working out a training program, or you think you may not have done such a good job handling somebody's grievance. Turn to the topic in this book and see how many ideas you can get. For this is a book of concrete suggestions—practical things you can put to work today and tomorrow—to help you do the most effective job you can as a foreman.

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FOREMANSHIP FUNDAMENTALS

By **A. L. Kress,** Formerly Chief Industrial Engineer, U. S. Rubber Co., Deputy Administrator Rubber Industry, N.R.A., Director Industrial Relations, N.E.M.A., 276 pages, 5½ x 8, **$2.50**

This book gives you practical, tested ways for handling specific situations. It shows you just how other foremen are meeting their responsibilities effectively under present-day conditions. It is concise, clear, direct, and stripped of all generalities. It gets down to cases.

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What men respond to—The right man on the right job—Training—Safety and accident prevention — Wages and rates — Handling grievances—Collective bargaining.

—the foreman and his production problems

The factory organization—Planning production schedules—Getting the most out of your day—The control of quality—Keeping costs down—Improving methods.

C. G. Stoll, President, Western Electric Company, says in the Foreword of the book. "This treatise will be most helpful to the foreman in getting a comprehensive picture of the many phases of his job and will serve as a ready reference from time to time as problems arise. Higher levels of management will profit by this review of the foreman's job and the consequent necessity for clearly defined sound company policies and practices."

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Written for foremen old in experience or newly on the job. Practical advice about personnel problems, finding the right men for the right job, training, safety and accident prevention, wages and rates, handling grievances, and all manner of production procedures. Includes several case studies and comprehensive index.

HOW TO CREATE JOB ENTHUSIASM

Carl Heyel, on the management staff of Union Bag & Paper Corp., McGraw-Hill Book Co., 330 W. 42nd St., New York. 248 pages. Index. $2.

Develops a formula for getting people to work so that they not only perform their functions properly, but also apply themselves in a manner that will make their tasks happier and their advancement more assured. Chapter headings include "Manifestations of Job Enthusiasm," "Five Things to Keep in Mind," "The 'We' Attitude," "Spontaneous Discipline," and others.

HEATING, VENTILATING, AIR CONDITIONING GUIDE, 1942

Published by American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York. 1250 pages. Photographs, tables, drawings. $5.

Volume No. 20. In three parts, Technical Data Section, Manufacturers Catalog Section, and Roll of Membership of the Society, plus complete indexes of the first two sections.

GAGES AND THEIR USE IN INSPECTION

Fred H. Colvin, editor emeritus, "American Machinist." McGraw-Hill Book Co., 330 W. 42nd St., New York. 157 pages. Photographs, drawings, index. $1.50.

Points out why gages are made, how they are constructed, and used, and makes clear many terms and questions about gages that arise in a shop.

THE SPECTER OF SABOTAGE

Blayney F. Matthews, superintendent of personnel, Warner Bros. Pictures, Inc. Lymanhouse, Los Angeles, Calif. 256 pages. Index. $3.

Outlining a protective plan for industrial plants, designed to reduce the threat of sabotage to a minimum; discussing the operations of saboteurs generally; and analyzing the effect of sabotage on civilian morale.

PLASTIC MOLDING

D. A. Dearle. Chemical Publishing Co., Brooklyn. 131 pages. Photographs, drawings, index. $4.

Designed to provide a general knowledge of plastics and numerous phases of manufacturing methods. Does not deal with chemical formulations, rather is devoted to the practical aspects of the industry. Chapter headings include Plastic Materials; Plastic Molding Tech-

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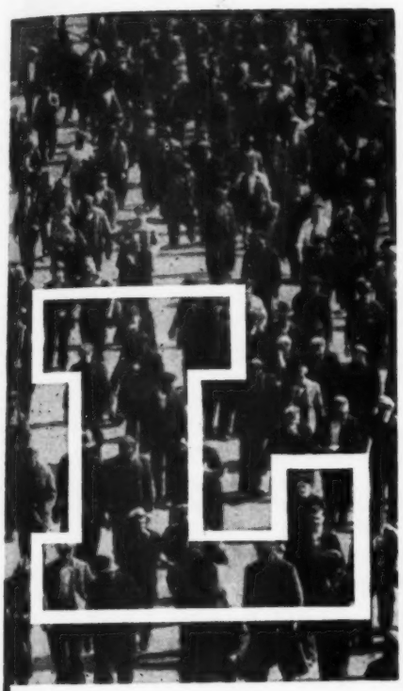

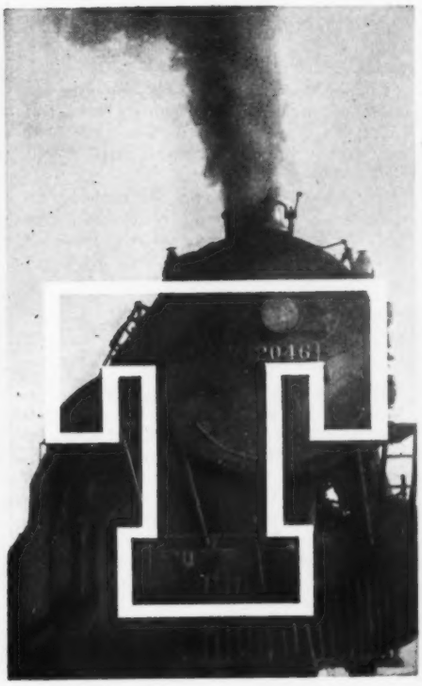

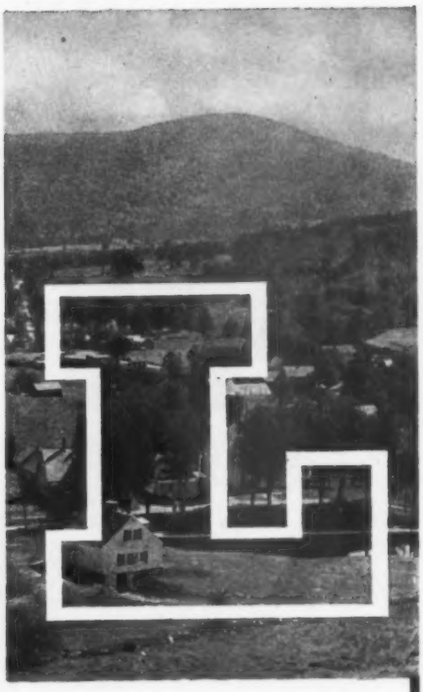

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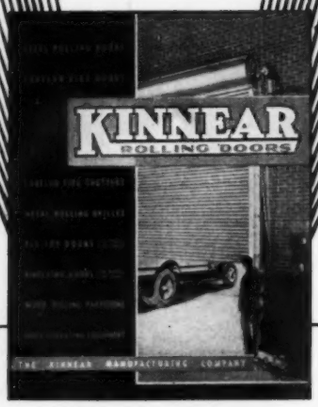

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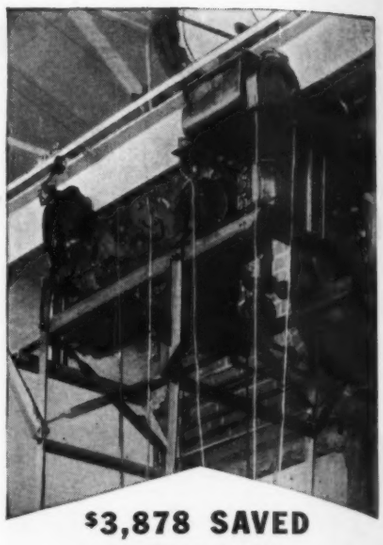

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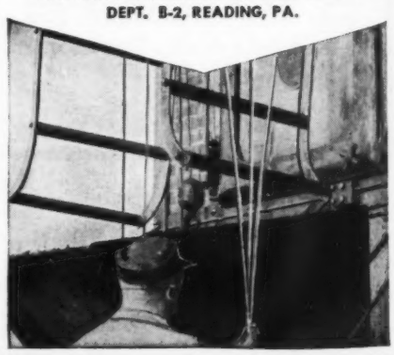

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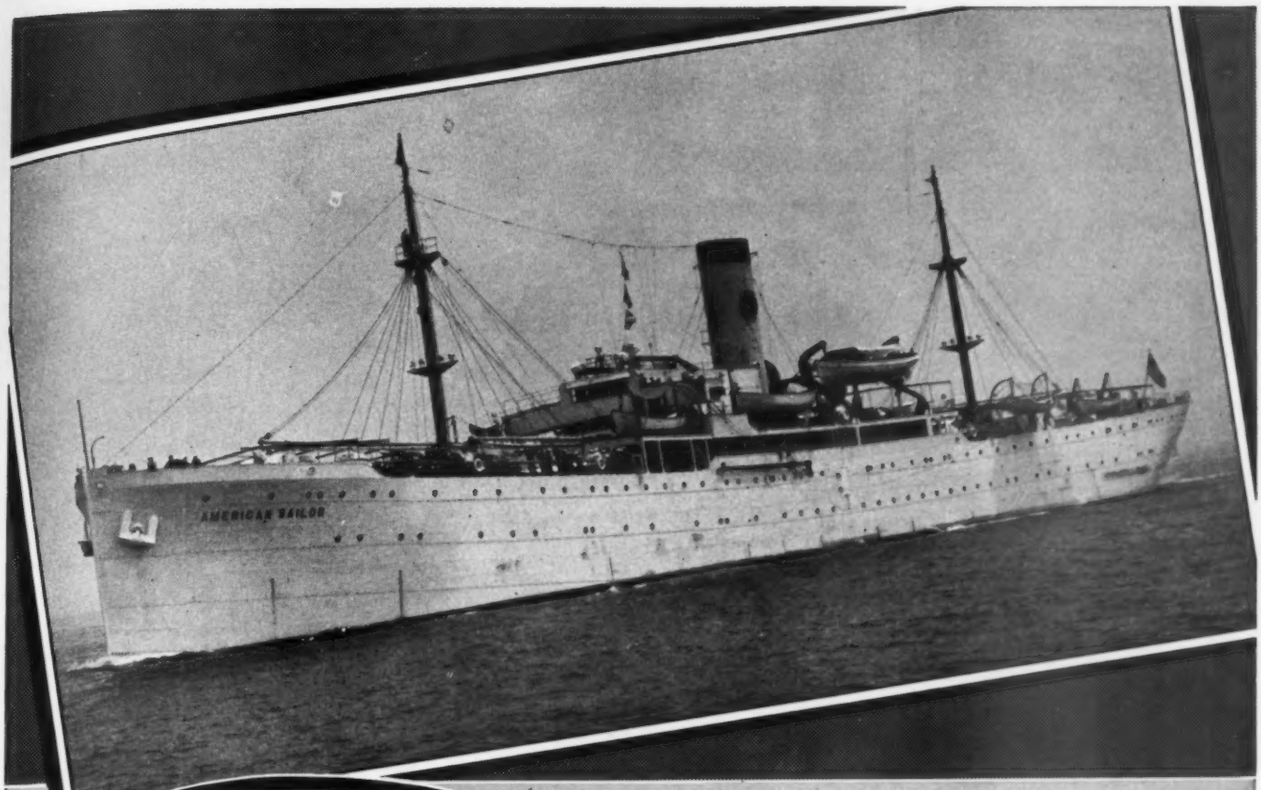

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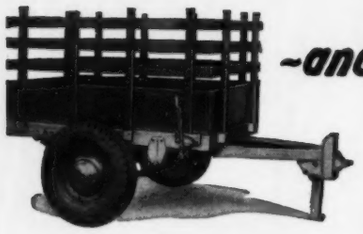

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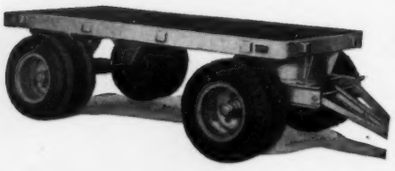

Among the hundreds of special handling problems solved by EWC Engineers, equipment has recently been produced to haul supplies and materials in various Army training camps.

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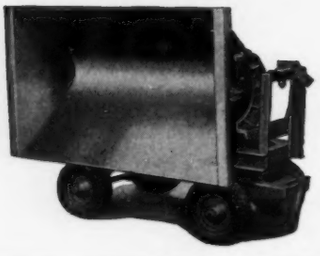

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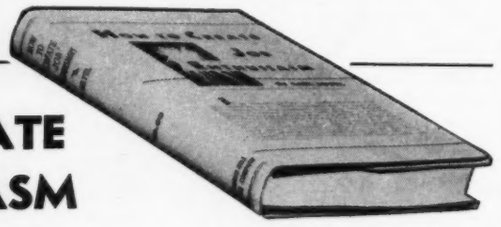

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By CARL HEYEL
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Co., 15 East 26th St., New York. 157 pages. Photographs, drawings, figures, index. $2.40.

A visualized method of instruction in how to read blueprints. Problems have been selected from classroom practice or formulated from industrial practice. Part I comprises general information, Part II sets forth problems and assignments.

SHOP THEORY

Prepared by Shop Theory Department, Henry Ford Trade School, published by McGraw-Hill Book Co., is priced at $1.25, not $1.75 as stated in the February issue of this magazine.

•

ON THE CALENDAR

MARCH

23–25, American Society of Mechanical Engineers, Spring Meeting, Houston. C. E. Davies, National Secretary, 29 West 39th St., New York.

APRIL

14–17, American Management Association, 12th Packaging Exposition, New York. Clapp & Poliak, Inc., 232 Madison Ave., New York.

20–24, The American Foundrymen's Association, The Foundry and Allied Industries Show in conjunction with 46th Annual Convention, Cleveland. American Foundrymen's Association, 232 West Adams St., Chicago.

27–30, Chamber of Commerce of the United States of America, Annual Meeting Washington, D. C. Ralph Bradford, Secretary, 1615 H St., N.W., Washington, D. C.

MAY

7–9, Society for the Advancement of Management, Semi-Annual Meeting, Cincinnati. Evelyn Buckley, Secretary, 29 West 39th St., New York.

11–13, American Institute of Chemical Engineers, Boston. Stephen L. Tyler, Secretary, 50 East 41st St., New York.

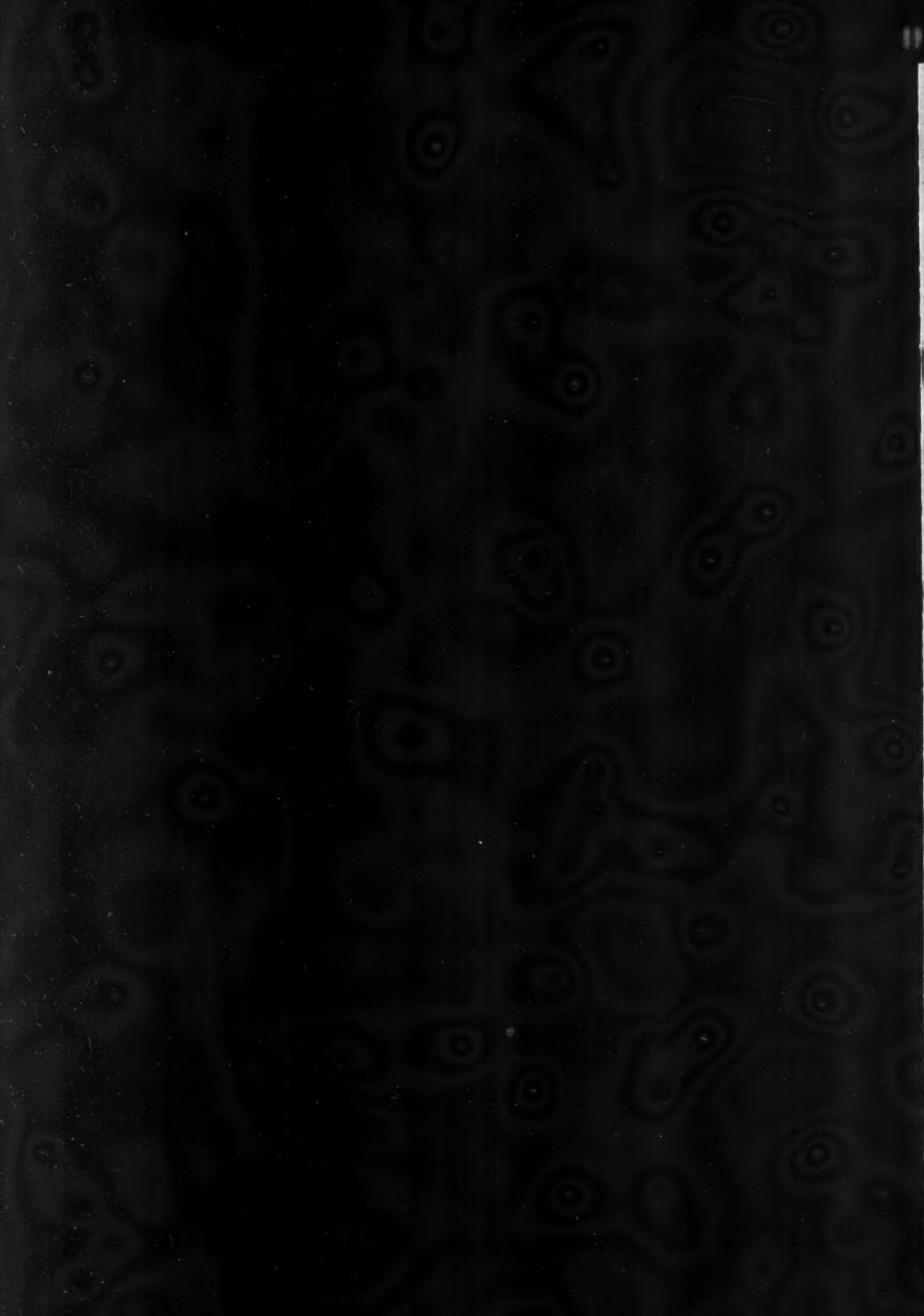
11–15, National Electrical Manufacturers Association, Annual Meeting, Hot Springs, Va. R. J. Blais, Convention Manager, 155 East 44th St., New York.

11–15, National Fire Protection Association, 46th Annual Meeting, Atlantic City. Percy Bugbee, General Manager, 60 Batterymarch St., Boston.

13–14, American Management Association, Production Conference, New York. Frank F. Gilmore, Conference Planning Manager, 330 West 42nd St., New York.

19–20, National Metal Trades Association, Annual Meeting, New York. Harry S. Flynn, Secretary, 60 East 42nd St., Room 710, New York.

25–28, National Association of Purchasing Agents, Annual Meeting, New York. G. A. Renard, Secretary, 11 Park Place, New York.



Engineering Lib.

"BEAT THE PROMISE"

HOW RCA BUILDS WORKER MORALE

To stimulate increased production of vital radio and sound equipment for our armed forces, RCA set in motion its deservedly successful "Beat the Promise" program which is conserving man power, machine time, and essential materials. Much of the spirit of the program and most of the techniques used to carry it out are set forth here for adaptation by the thousands of industrial plants we all are counting on to deliver "too much too soon"

IN TWO PARTS
PART TWO FACTORY MANAGEMENT AND MAINTENANCE MARCH 1942

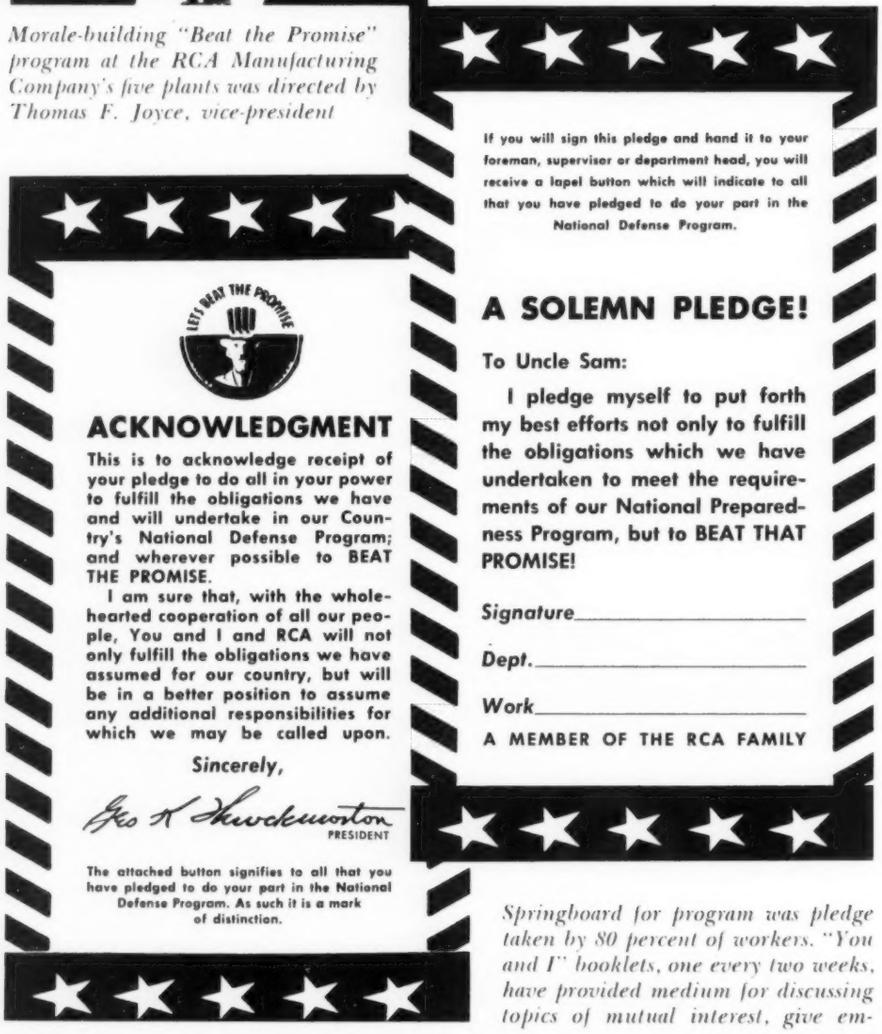
ORGANIZING TO "BEAT THE PROMISE"

Morale-building "Beat the Promise" program at the RCA Manufacturing Company's five plants was directed by Thomas F. Joyce, vice-president

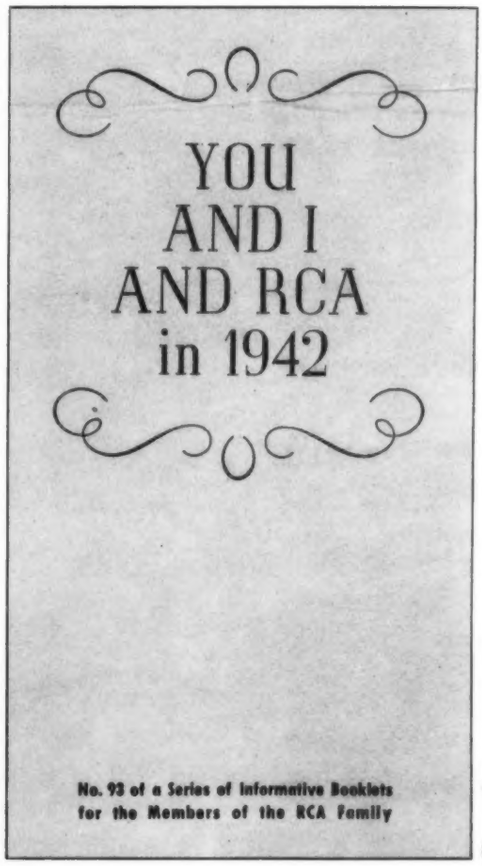
AS FAR BACK as September, 1939, when war broke out in Europe, G. K. Throckmorton, then president, now chairman of the executive committee, RCA Manufacturing Company, foresaw the vital role his company would be called upon to play in a war that placed so much emphasis on the value of communications. At that time, long-range plans were made to divert facilities, machinery, materials, money, and man power to national defense and war production.

Most important consideration in any long-range program is the spirit and unity of the people who must be counted upon to carry it through. Obviously, the entire organization up and down the line must be awakened to the need and the urgency of the program. Out of all this preliminary thinking grew the "Beat the Promise" program (often referred to in the following pages as BTP).

Under the energetic supervision of Thomas F. Joyce, vice-president in charge of the company's public relations and internal education, the program took form and shape. Much groundwork had already been laid through previous employee education. Informal discussions presented in "You and I and RCA" booklets, the company house organ, a high-geared employee suggestion system, and similar personnel activities helped prepare the way. Also, although the first phase of the program has now been brought to a successful conclusion, the job is by no means done. Continuous effort must be made to keep an organization fully informed of fundamental objectives and of mutual problems.


LET'S BEAT THE PROMISE
ACKNOWLEDGMENT
This is to acknowledge receipt of your pledge to do all in your power to fulfill the obligations we have and will undertake in our Country's National Defense Program; and wherever possible to BEAT THE PROMISE.
I am sure that, with the wholehearted cooperation of all our people, You and I and RCA will not only fulfill the obligations we have assumed for our country, but will be in a better position to assume any additional responsibilities for which we may be called upon.
Sincerely,
Geo K Throckmorton
PRESIDENT
The attached button signifies to all that you have pledged to do your part in the National Defense Program. As such it is a mark of distinction.
If you will sign this pledge and hand it to your foreman, supervisor or department head, you will receive a lapel button which will indicate to all that you have pledged to do your part in the National Defense Program.
A SOLEMN PLEDGE!
To Uncle Sam:
I pledge myself to put forth my best efforts not only to fulfill the obligations which we have undertaken to meet the requirements of our National Preparedness Program, but to BEAT THAT PROMISE!
Signature_____
Dept._____
Work_____
A MEMBER OF THE RCA FAMILY

Springboard for program was pledge taken by 80 percent of workers. "You and I" booklets, one every two weeks, have provided medium for discussing topics of mutual interest, give employees facts about their company. Thus RCA people were unusually well informed, knew what the war meant to America, to industry, to RCA, and to themselves even before the BTP program was set in motion



Primarily, the "Beat the Promise" program is a drive for more production in less time, in accordance with the nation's urgent needs. The first campaign was organized to run for three months. Subsequent three-month campaigns are scheduled for the duration, allowing one-month intervals between campaigns for consolidation of gains and the preparation of plans for the next campaign.

Today, with the production facilities of all five RCA plants given over almost 100 percent to the manufacture of radio and sound equipment so urgently needed by our armed forces, the sole objective of the BTP program is to *beat the delivery promise* on all war orders, and to accomplish this objective with the maximum conservation of critical materials, machine time, floor space, and man power.

An Old American Custom

Because the spirit of competition is a fundamental American trait, it has been made the prime mover of the "Beat the Promise" plan. The competitive idea had its inspiration from a suggestion that Secretary Knox made to a group of prominent shipbuilding executives and others from contributing defense industries, early in the defense program. This spirit of competition recognizes individual as well as group effort. Individual effort is pitted against individual, department against department, division against division, plant against plant – and all are united in the struggle to outdo the production output of those working for Japan and Germany.

To carry out this concept of plant against plant, division against division, department against department, and individual against individual, and to foster the spirit of competition, the program is set up as follows:

1. Each of the five RCA plants is judged by its performance:

Against its production schedule.

In comparison with the performance of other RCA plants.

Number of acceptable BTP suggestions made by employees.

2. Each manufacturing division within a plant is judged by:

Its performance against its production schedule.

Its performance in comparison with the other divisions of the plant.

Number of acceptable BTP suggestions made by employees.

3. Each department is judged by:

Its performance against its production schedule.

Its performance in comparison with the other departments within the division.

Number of acceptable BTP suggestions by employees.

4. Each individual employee is judged by his or her contribution to the success of the effort and the BTP suggestions accepted.

G. K. Throckmorton, chairman of executive committee, awards Defense Bonds to worker who has made a BTP suggestion

President's flag – symbols are radio-tube elements – is flown by the manufacturing plant with the best record of the month

Plant manager presents life-size figure of Uncle Sam to winning department, which holds it for the ensuing week

USHERING IN THE IDEA WITH MYSTERY

WITH THE PLAN fully developed, much thought was given to the dramatic presentation of the idea. V for Victory had just become universally known. Ed Jones, RCA Manufacturing Company's engineering products advertising manager, an old-time wireless operator, noted that the reverse of the V's three dots and a dash for Victory stood for "B" in radio and telegraph code. "B" for what? "B" for *Beat the Promise* – the slogan embodied in the pledge that many of the employees had signed many months before.

Shortly before the program began, all employees received a cryptic Radiogram with their pay checks. On sidewalks and bulletin boards for many blocks surrounding the plant areas, the mystic symbol "B" appeared. Radio listeners on local stations heard this dash and three dot symbol repeated many times with only a hint of explanation. For three days factory whistles in the vicinity tooted the signal. All the neighborhood newspapers carried a small, square advertisement reading: "Notice to all Members of the RCA Family —"B" – . . . September 2nd." Posters appeared on bulletin boards with the same "B" symbol, with no other information except the single thought-provoking statement, "We pledge it; we'll beat it!"

An enormous amount of anticipation was built up before the mystery was solved three days before the inaugural rally, which was staged outside of each RCA plant. Then the current issue of the "You and I and RCA" booklet told the story. A new BTP house organ made its debut with full details of awards and prizes. Each employee received a "B" button with explanatory card, and the program was fairly under way.

FAST — DIRECT

RCA

RADIOGRAM

R.C.A. COMMUNICATIONS, INC.

A RADIO CORPORATION OF AMERICA SERVICE

TO ALL THE WORLD — BETWEEN IMPORTANT U. S. CITIES — TO SHIPS AT SEA

Send the following Radiogram "Via RCA" subject to terms on back hereof, which are hereby agreed to

AUGUST 15, 1941

FELLOW WORKERS

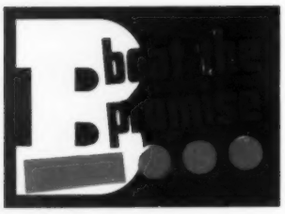
— • • • THIS IS RADIO CODE FOR A SYMBOL THAT HAS TREMENDOUS SIGNIFICANCE TO YOU AND ME AND USA. YOU AND I WILL SEE IT, HEAR IT, STRIVE FOR IT AND LEARN MORE ABOUT IT SOON.

G K THROCKMORTON
President

No one approaching RCA plant areas could avoid seeing the "B" for Beat the Promise

Patriotic posters in full color were posted every two weeks on all bulletin boards and in other conspicuous places. Black and white drawings in cartoon style were also prepared to convey specific ideas – what individuals could do to Beat the Promise

A "B" sticker was placed on all inter-department correspondence



LET'S BEAT THE PROMISE!

This button is the symbol of the BEAT THE PROMISE CAMPAIGN which will be inaugurated in all our plants and offices September 2nd.

Wear it prominently in the months ahead as a reminder of the tremendously increased responsibilities which the RCA Family has undertaken in our Country's National Defense program.

We hope, too that it will arouse the ...iosity of our friends and neighbors ... ask what the B ...

LINKED TOGETHER FOR SAFETY AND DEFENSE

BEAT THE PROMISE

DRAMATIZING THE IDEA FOR THE EMPLOYEES

A MESSAGE FROM DAVID SARNOFF

Today we inaugurate the "Beat the Promise" effort. It signalizes to the world that RCA men and women are going to do all within their power to fulfill the obligations which we as a family of workers have assumed in connection with the country's national defense program.

Defense has had and will have the right of way in all our plants and with all our fellow-workers . . .

Now through the medium of radio code, which incidentally is the service on which our company was originally founded, I officially inaugurate this morale-building program in all our plants throughout the country by sending our campaign slogan, "Beat the Promise" — · · · — · · · — · · ·

FROM HIS OFFICE on the 53rd floor of the RCA Building in New York, David Sarnoff, president of the Radio Corporation of America (an old-time wireless operator himself), tapped out the BTP message.

Twenty thousand men and women in all five RCA plants heard this message in outdoor rallies and through plant sound systems. They heard him declare, "National Defense has the right of way in all RCA plants," and they heard him pledge the RCA Family to Beat the Promise. To account for time differences across the country, Mr. Sarnoff's message was electrically transcribed and reproduced through indoor and outdoor sound systems. Participating in the inaugural ceremonies were plant executives, Victor recording artists, regional Army and Navy officials.

Then, at regular intervals, elaborate outdoor and indoor rallies were staged at noontime and at night, so that workers and their families *could visualize the uses to which their equipment was being put in the country's services.*

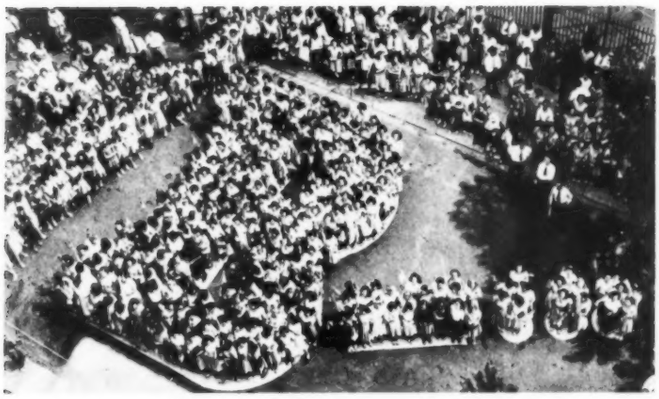
John B. Kelly (former Olympic rowing champion and now director of national physical training) and Alice Marble (former women's tennis champion and now assistant director) were enlisted to stage a "Hale America" program emphasizing the importance of keeping fit to Beat the Promise. The U.S. Coast Guard exhibited radio equipment, and staged a thrilling breeches buoy rescue from a third-floor factory window.

Parties of Army and Navy officers toured the plant, were photographed with outstanding workers, and awarded BTP decorations publicly. British Navy officers from nearby shipyards also visited the plant, and told of thrilling sea battles in which radio figured importantly. Foot troops, a 30-ton tank, batteries of anti-aircraft guns and searchlights, Signal Corps communications equipment, a pigeon loft, a bomber plane, and even a Navy Blimp – all staged stirring maneuvers. Lanny Ross, Barry Wood, Lucy Monroe, Bea Wain, and other artists lent their glamorous presence and talents to similar rallies.

At frequent intervals, too, the company song, "RCA's Gonna' Beat the Promise," the national anthem, and other patriotic music were broadcast through plant sound systems.

Plant officials make BTP announcements through mobile sound system, which supplements regular sound installation

Plant sound system permits workers on the night shift to hear BTP rallies through the playing of recorded transcriptions



Workers at Harrison radio tube plant form the magic "B" symbol

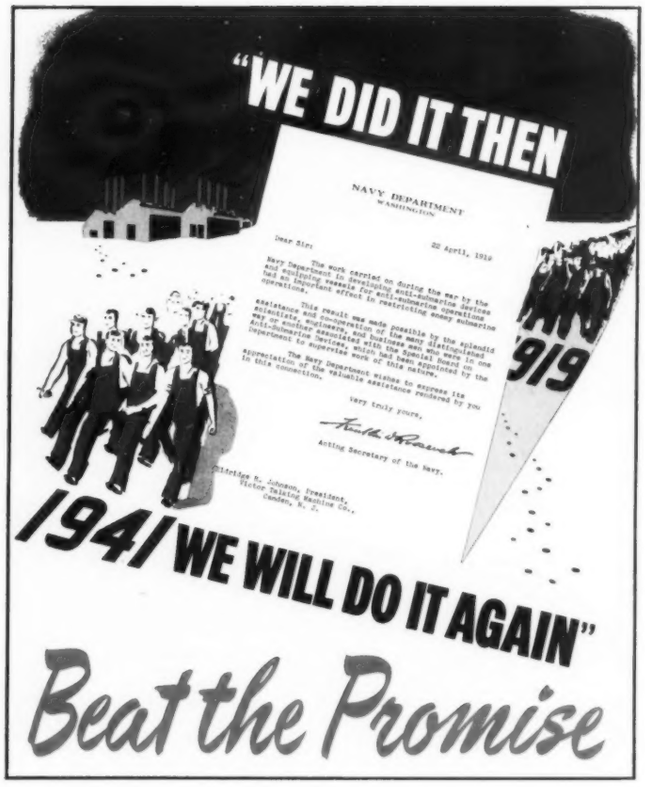
Opening rally in park adjacent to Camden plant attracted thousands

It takes four RCA girls to hold up one of the many 8- and 16-ft. banners that were hung conspicuously in all company plants

Girl is "rescued" in breeches buoy by U. S. Coast Guard at one of the noonday rallies held weekly during the BTP program

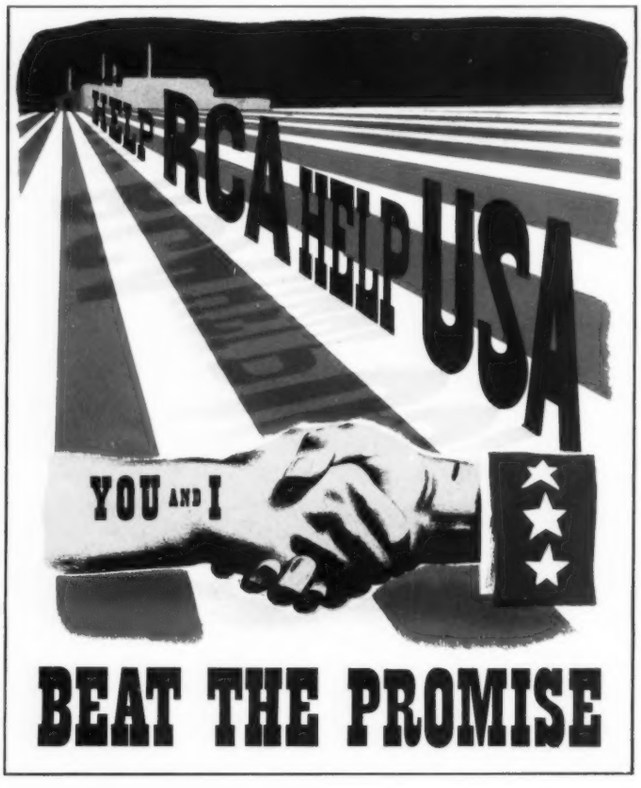
Major General Olmstead, Chief Signal Officer, talks to factory workers, later decorated employees with BTP emblems

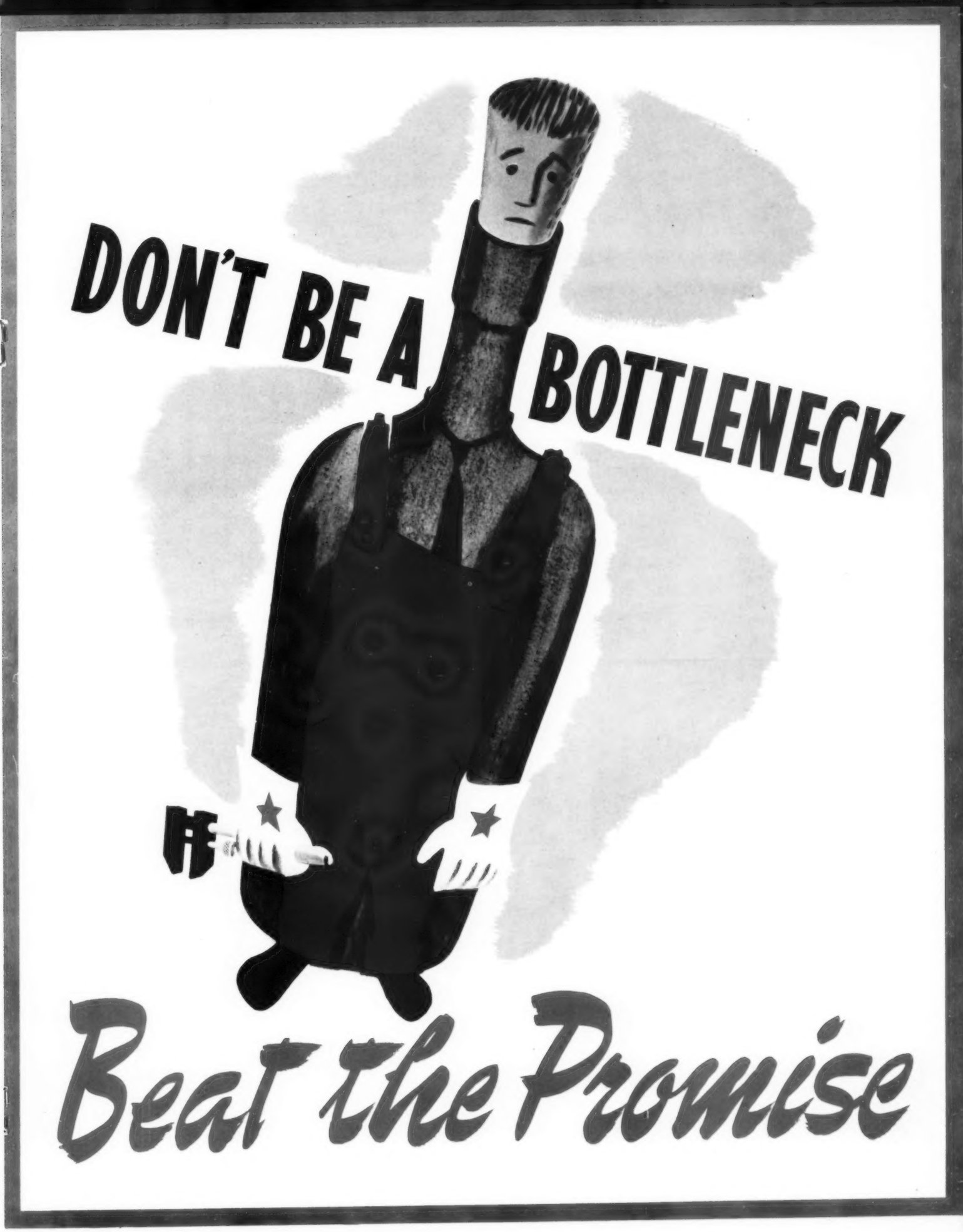
Admiral Watson congratulates RCA defense worker as British Navy officers stand by. The admiral also made BTP awards



DRAMATIZING THE IDEA

PATRIOTIC POSTERS prepared by RCA Manufacturing Company's own advertising department, inspired employees to make good their pledges to Beat the Promise




DON'T BE A BOTTLENECK
Beat the Promise

HE WASN'T SURE BUT DIDN'T BOTHER ASKING
HE USED THE WRONG TOOLS
SHE DIDN'T FOLLOW INSTRUCTIONS CAREFULLY
HE DIDN'T THINK THE JOB THROUGH!
HE DIDN'T BOTHER TO TRY A BETTER WAY TO DO IT

SQUEEGEE'S UNINTENTIONAL LITTLE HELPERS

CLANG!
NATIONAL DEFENSE PRODUCTION
100% EFFECTIVE EFFORT
GAD!!- WHAT A WALLOP!! THIS IS NO PLACE FOR ME!
YOU & I
BEAT THE PROMISE CAMPAIGN

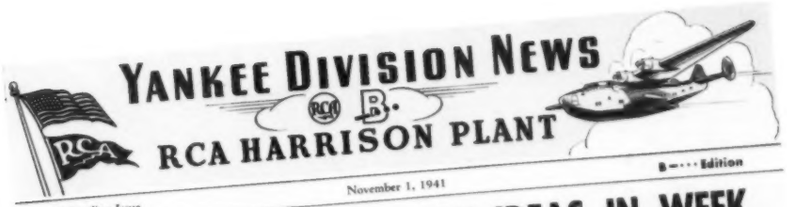
MAKE EACH SECOND A SLEDGE-HAMMER BLOW FOR DEFENSE!

PERHAPS MANY LIVES WILL DEPEND ON IT!
IT'S JUST A RADIO! - YOU ACT LIKE SOMEONE'S LIFE DEPENDED ON IT-!!
YOU & I
SQUEEGEE THE 5TH COLUMNIST

YOU'RE DARN TOOTIN'! OUR NATION'S ARMED FORCES RELY UPON US FOR DEPENDABLE EQUIPMENT

DRAMATIZING THE IDEA

SQUEEGEE the fifth columnist is a scapegoat character who represents waste, carelessness, delay, and all other hindrances to all-out effort. Behind smiling mask and outstretched hand he holds a dagger. Squeegee was placed prominently on all floors with appropriate "blurb balloons" which were changed every two weeks. Zealous employees blacked his eyes, slit his throat, made it clear in countless other ways where he stood with them

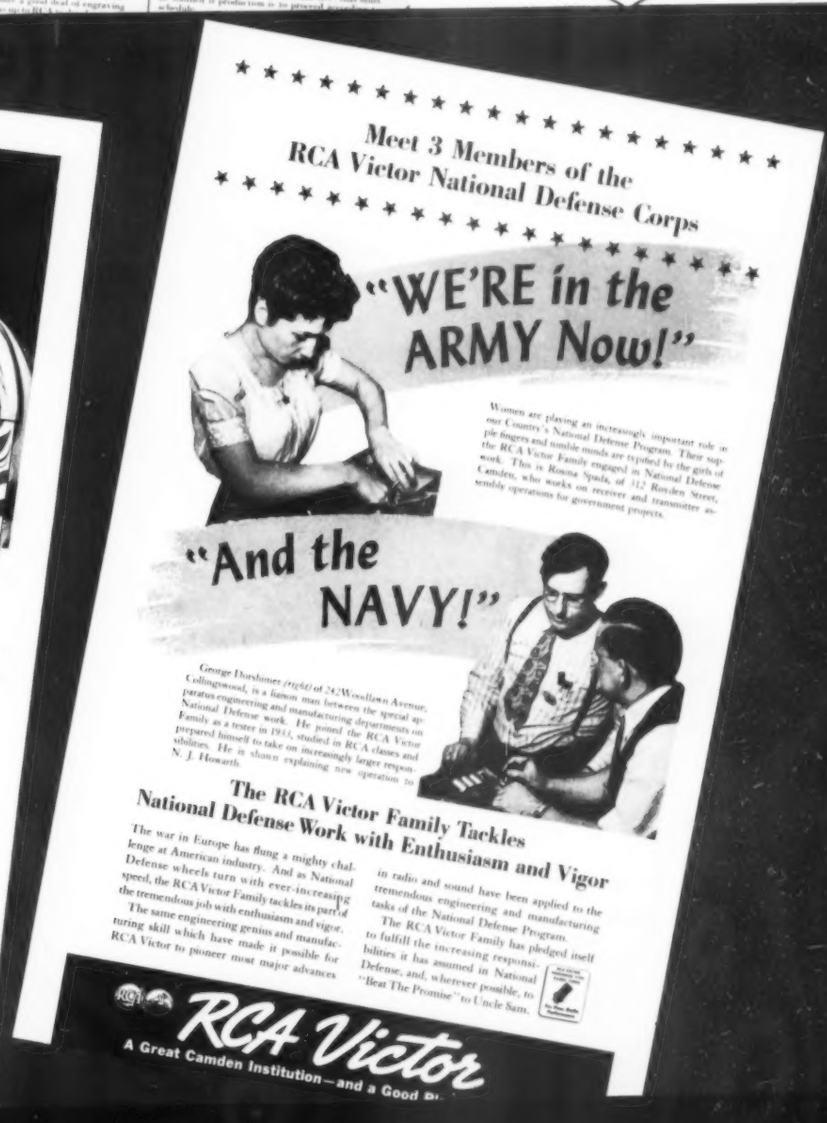


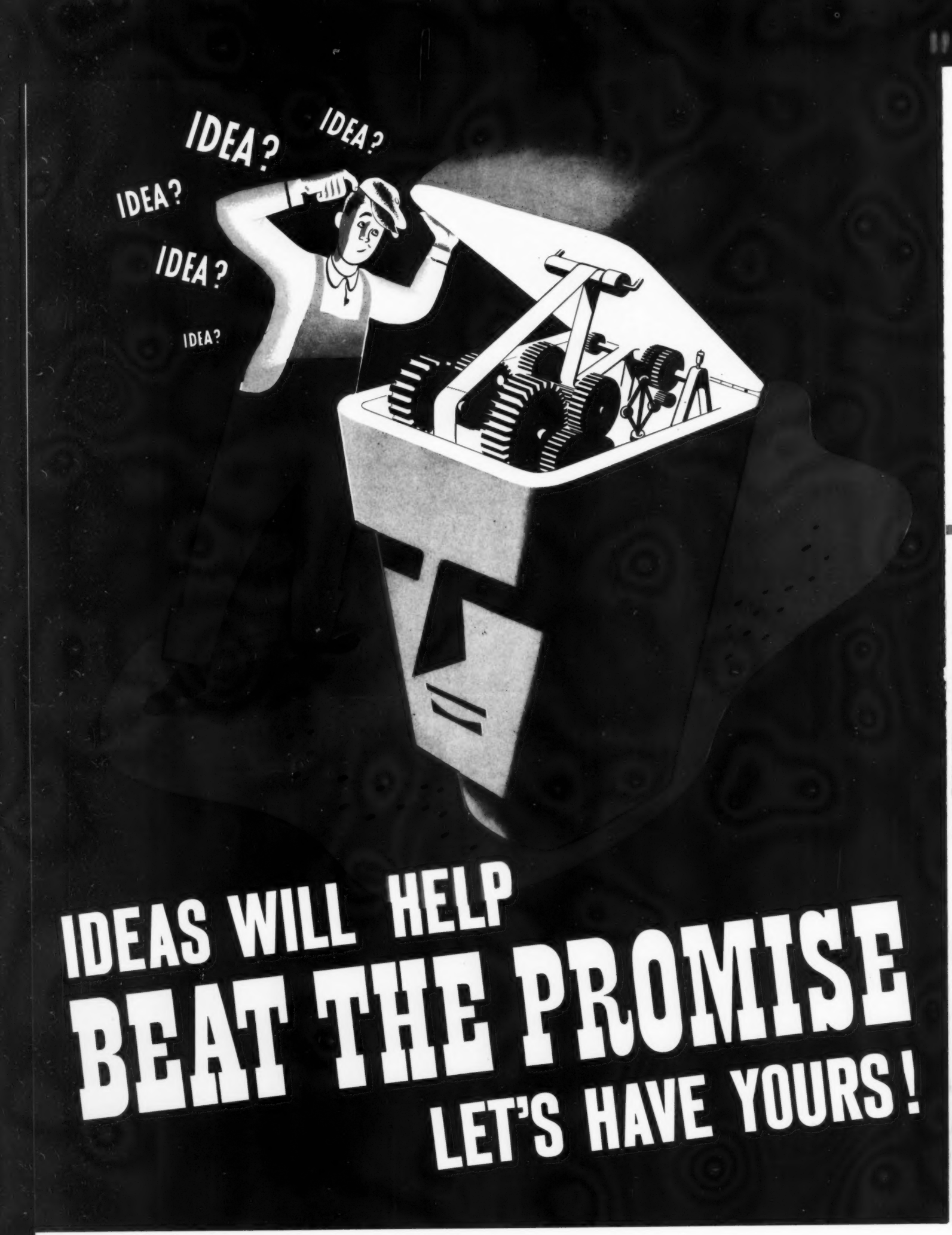
Bi-monthly house organ, originating at the Camden plant, gives news of BTP efforts, standings of individual workers, departments, and plants. Other plants prepare special inserts which are distributed to employees with the main issue

Beat the Promise
FOURTH ISSUE
EDITED BY "YOU AND I" AND RCA FOR UNCLE SAM
OCTOBER 1941
AT THE HALF-WAY MARK
AND WE'RE GOING STRONG
GIRLS - - AN ORCHID FOR YOU!
Notes on Progress
Second Half

Series of weekly advertisements in local newspapers told neighbors and families of employees a continuous story of the part RCA is playing in America's war production program

The Man Behind
The Man Behind the Gun!
Father and son, though separated, are united in the common cause of National Defense
RCA Victor
A Great Camden Institution—and a Good Place to Work


Meet 3 Members of the
RCA Victor National Defense Corps
"WE'RE in the ARMY Now!"
"And the NAVY!"
The RCA Victor Family Tackles
National Defense Work with Enthusiasm and Vigor
RCA Victor
A Great Camden Institution—and a Good P

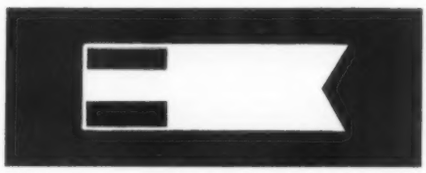

IDEA?
IDEA?
IDEA?
IDEA?
IDEA?
IDEAS WILL HELP
BEAT THE PROMISE
LET'S HAVE YOURS!

MORE THAN 36,000 SUGGESTIONS

IN THE FIRST THREE MONTHS of the BTP program the 20,000 workers in RCA plants actually made 36,872 suggestions, many of which made possible substantial improvements as well as important savings in materials, machine hours, and man power.

A good, workable suggestion system is valuable in stimulating employees to think about their jobs. Great care must be exercised to administer such a plan with complete fairness and to answer suggestions promptly.

For many years RCA Manufacturing Company has been encouraging its workers to make suggestions through a well-organized suggestion plan in all its plants. Obviously, the suggestion system is another direct means through which the individual worker is enabled to make his or her personal contribution toward production for victory. The rewards include cash, based on a percentage of actual savings, special merchandise prizes to encourage suggestions, a yearly "best" award, and, as additional incentive in this case, all-expense-paid trips to Miami Beach.



Merit pins are given to all workers in a department that succeeds in beating its promises for four weeks. A star is added for each additional two weeks of BTP performance. Ten weeks rate three stars

There is added incentive when a big Navy man like Admiral Watson makes the awards

Departments — this one the "Two-Ocean Navy" — create rivalry with own posters

The Army, too, in the person of General Olmstead, decorates deserving workers

Champions Kelly and Marble lend glamour to ceremony, encourage more suggestions

Suggesting is made easy by placing boxes on employee thoroughfares in all plants

And Lanny Ross poses here after pinning medals on a group of suggestion-makers

ADDING UP THE SCORE

NOW FOR THE RESULTS. First and foremost, RCA workers understand now that this is primarily a war of production. It is not merely the armed forces of the United Nations versus those of the Axis Powers. It is also RCA against Telefunken, Bethlehem against Krupp, Curtiss-Wright and Bell and Lockheed against corresponding German aircraft companies.

Through the BTP program, 20,000 RCA employees have come to a fuller realization of the roles they have to play.

They know that they must back up our armed forces on land and on sea with vital radio and sound equipment.

They know, as few other groups of industrial employees now know, that it is their main job to deliver "too much too soon."

Nowhere is this new spirit of RCA workers more clearly evidenced than in the results of the recent Defense Bond drive at the Camden plant. Replying to General Dawson Olmstead, Chief Signal Officer, at the opening rally, Joseph E. Mitton, president of Local 103, UERMWA, made this pledge:

"On behalf of Local 103, UERMWA, affiliated with the CIO, I want to pledge the wholehearted efforts of every man and woman in our union to support to the utmost the program to supply our Army and Navy with the radio and sound equipment that is so vital to our national defense. You may be sure that these thousands of loyal American citizens will spare no effort in Beating the Promise on every commitment which the RCA organization has made to Uncle Sam and our fighting forces. Not only will we do everything in our power to deliver the equipment on time. We will also make it of such dependable quality that it will not fail our armed forces in their hour of need."

Employees responded so wholeheartedly that 92 percent at the Camden plant are participating as of February 20, and are actually allotting 6.75 percent of total payroll to the purchase of Defense Bonds.

For a few of the more tangible results — how promises were beaten on specific orders for war matériel, how department after department went over the top in the battle of production — see the list below.

RESULTS

☆ A Signal Corps order for many thousands of radio and sound units *delivered one year early*

☆ Another Signal Corps order at the tube plant at Harrison, N. J., for 43,000 units *delivered sixteen months ahead of schedule*

☆ A flood of constructive suggestions from employees in all plants, all departments — 36,872 actually were sent in

☆ Delivery time on repairs reduced by more than 80 percent

☆ Typical factory departments were able to beat their promises by the following percentages:

Shipping	120%	Amplifiers	130%
Repairs	163%	Transmitters	120%

☆ Promises were beaten on certain defense equipment for thirteen consecutive weeks

"E" in Navy code signifies absolute tops in achievement. The "E" flag is therefore the highest compliment the Navy can pay a plant, has thus become the most coveted award in industry today. Here Admiral W. C. Watts presents it to RCA employees in recognition of their outstanding contributions to the war production effort

SUGGESTION STANDINGS FINAL

SQUAD	NUMBER OF SUGGESTIONS
HARRISON	5054
HOLLYWOOD	229
INDIANAPOLIS	3726
BLOOMINGTON	1379
FIGHTING 69th CAMDEN	11262
ROUGH RIDERS CAMDEN	11695
2 OCEAN NAVY CAMDEN	2698
HELL DIVERS CAMDEN	829

Right after Pearl Harbor, 20,000 workers (top, left) pledged allegiance to the flag, rededicated themselves to the task ahead

Giant thermometers (top, right) show that RCA workers will buy bonds till it hurts

BTP suggestions (left) reached 36,872 total

Cashier's office (right) is swamped with orders authorizing payroll deductions

Joseph E. Mitton, president, Local 103, UERMWA, took part (below, left) in many of the rallies, pledged support of union members

(Below, right) "You and I and RCA," said Robert Shannon, president, RCA Manufacturing Company, "have demonstrated our ability to back up our armed forces. We will continue with renewed vigor"

HOW RCA WILL KEEP ON BUILDING MORALE

Squeegee, unmasked at last, turns out to be one of those friendly little Japs

FIRST THREE-MONTH PHASE of the BTP program ended just before the declaration of war. As our country's need became more urgent, industrial morale also assumed greater importance. Thus at RCA the BTP program took on even greater significance.

Following the pattern that had proved so successful, RCA launched the second phase of the program in January. The BTP slogan and "B" symbol have been retained, but production guns have now been trained on the treacherous Japs. "Put the squeeze on the Japanese" has become the new battle cry.

Posters, banners, buttons, cartoons—all proclaim the new theme. There are new Uncle Sam and merit awards; the president's flag remains in monthly competition. All the tried and proved devices of the first program are retained with new variations. To them have been added many new twists to fit new problems and new developments.

The entire RCA family, over 20,000 strong, are more determined than ever, not only to beat their promises to Uncle Sam, but also to win the battle of production for victory.

Second series of catchy cartoons urges RCA workers to stay in there punching

Added to the old war cry is a brand-new one, "Put the Squeeze on the Japanese"